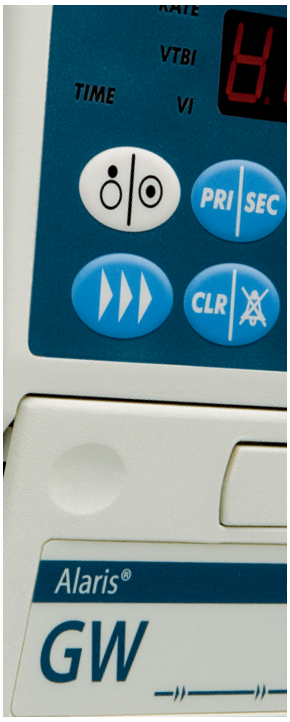


Alaris® GW Volumetric Pump

Technical Service Manual

CE
0086

CareFusion

Contents

1 General Information

Introduction

The Alaris® GW Volumetric Pump is designed to deliver a continuous and accurate infusion. High performance, comprehensive alarm protection and sophisticated monitoring systems, combined with simple operation, make this pump ideal for general care and critical care in a variety of areas within a hospital.

The Asena® brand name has been changed to the Alaris® brand name. This change in brand name has no effect on the intended use or functionality of the product. Recommended disposable products for use with this product may refer to either the Asena® brand name or Alaris® brand name and both types are suitable for use with this infusion pump.

Product Familiarity

Before operation, ensure that you are fully familiar with this pump by carefully studying the Directions for Use (DFU) prior to attempting any repairs or servicing.

As part of a policy of continuous improvement, product enhancements and changes are introduced from time to time.

Purpose of this Manual

This Technical Service Manual describes how to set up, test and maintain the Alaris® GW Volumetric Pump. It is intended for use by personnel experienced in medical equipment testing and maintenance procedures.

Conventions Used in this Manual

BOLD	Used for Display names, self-test codes, controls and indicators referenced in this manual, for example, **Battery Indicator**, access code **212**, **ON/OFF** button.
'Single quotes'	Used to indicate cross-references made to another section of this manual. For example, see Chapter 2, 'Configuration and Calibration'.
underline	Used to indicate a link to another section within this manual.
Italics	Used to refer to other documents or manuals. For example, refer to the relevant Directions for Use (DFU) for further information. Also used for emphasis, for example, ...if the gap *still* measures less than...
	Wherever this symbol is shown a Hints and Tips note is found. These notes provide useful advice or information that may help to perform the task more effectively.
	Wherever this symbol is shown an Update note is found. A typical example is drawing attention to a software upgrade that should be confirmed has been installed.
	Wherever this symbol is shown an Important note is found. These notes highlight an aspect of test or maintenance that is important to know about.

Operating Precautions

Please read the general Operating Precautions described in the Directions for Use carefully prior to using this pump.

This pump contains static-sensitive components. Observe strict precautions for the protection of static sensitive components when attempting to repair and service the pump.

An explosion hazard exists if the pump is used in the presence of flammable anaesthetics. Exercise care to locate the pump away from any such hazardous sources.

An electrical shock hazard exists if the casing of the pump is opened or removed. Refer all servicing to qualified service personnel.

This pump is protected against the effects of high energy radio frequency emissions and is designed to fail safe if extremely high levels of interference are encountered. Should false alarm conditions be encountered, either remove the source of the interference or regulate the infusion by another appropriate means.

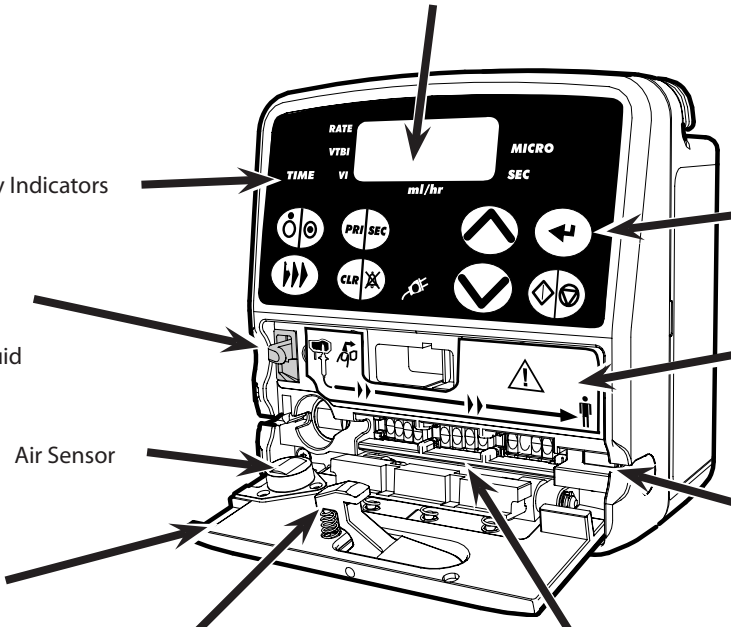
If the pump is dropped, subjected to excessive moisture, humidity or high temperature, or otherwise suspected to have been damaged, remove it from service for inspection by a qualified service engineer.

When connected to an external power source, a three-wire (Live, Neutral, Earth) supply must be used. If the integrity of the external protective conductor in the installation or its arrangement is in doubt, the pump should be operated from the battery.

Views of the Alaris® GW Volumetric Pump

Front view

Main Display - Displays the infusion rate, VTBI, VI and time remaining for VTBI / Time infusions. Display will flash when pump is operating on battery.



Display Indicators

Keypad

Flow Stop Mechanism

When activated the mechanism will stop fluid flow.

Flow Direction Label

Air Sensor

Pressure Sensor

Bevel

Releases the flow stop mechanism lever arm when the door is closed.

Door Latch

Press outer latch to open the door.

Tubing Guide

Guide to assist in the loading of the IV infusion set.

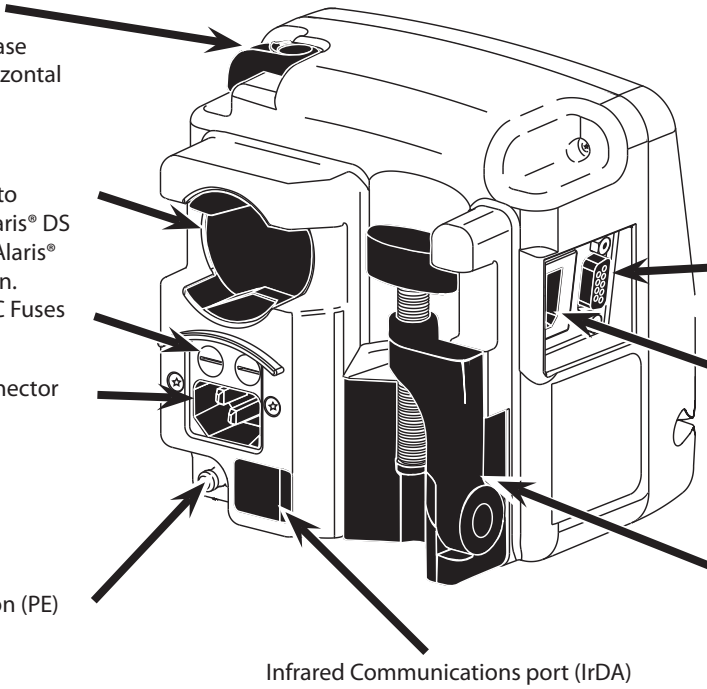
Rear view

Release Lever

Rotates cam to release the pump from horizontal rectangular bars.

Rotating Cam

Attaches the pump to rectangular bars, Alaris® DS Docking Station or Alaris® Gateway Workstation.



RS232 Connector / Nursecall

AC Fuses

AC Power Connector

Flow Sensor Interface

Potential Equalisation (PE) Connector

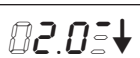
Folded Pole Clamp

Infrared Communications port (IrDA)

Controls and indicators

	**PRIMARY / SECONDARY** Switches the pump between Primary and Secondary infusion modes (if enabled).
	**ON / OFF** Switches the pump on and off.
	**PRIME / BOLUS** Primes the IV infusion set. Administers bolus during the infusion.
	**CLEAR / SILENCE ALARM** Resets numeric values to zero. Silences alarms and warnings for 1 minute.
	**ENTER** Scrolls between rate, time, VTBI and total volume infused (VI). Enters values for selected infusion/configuration parameters. Confirms the rate during an infusion titration.
	**RUN / HOLD** Starts and stops the infusion. Cancels alarm.
	**CHEVRONS** Increases or decreases the infusion rate, TIME limit and VTBI. Press and hold to increase the selection speed. Used to adjust user selectable options.

When any of the following are illuminated:

	**AC POWER INDICATOR** - The pump is connected to an AC power supply.
RATE	The pump is displaying the infusion rate in millilitres per hour (ml/h).
VTBI	The pump is displaying the Volume To Be Infused (VTBI) in millilitres (ml).
VI	The pump is displaying the Volume Infused (VI) in millilitres (ml).
TIME	The pump is displaying the infusion time in hours : mins.
MICRO	The pump is operating in the MICRO mode. When not illuminated, the pump is in the STANDARD mode.
SEC	The pump is operating in the SECONDARY mode. When not illuminated, the pump is in the PRIMARY mode.
ml/hr	(Millilitres / hour) When ml is illuminated the pump displays the VTBI or VI. When the hr is illuminated the pump displays the rate or infusion time.
	Infusion indicator - Infusing in STANDARD mode.
	Infusion indicator - Infusing in MICRO mode.
	Infusion indicator - Displays fluid drops detected by the flow sensor when infusing in STANDARD mode.
	Infusion indicator - Displays fluid drops detected by the flow sensor when infusing in MICRO mode.

2 Configuration and Calibration

Access codes

The pump software contains a number of configuration and test routines that can be accessed by the user. The majority of tests are driven from a technical access code (see below).

Entering Access Codes

With the pump OFF.

Press and hold ▽ and press and release ⏻.

The pump will alarm and briefly show the software version installed in the pump. It will then display **CodE**.

Release the ▽ key and the pump will display **0**.

Use the △ ▽ keys to select the code required from the list.

Press the ↵ key to confirm your choice.

If an invalid code is entered, the pump will display **CodE** followed by **0**.

Configurable options

Note: The default settings are configurable as displayed in the table below.

Note: Each of the configurable options has a code which must only be altered by a qualified service engineer with reference to the technical service manual.

Note: Any changes made that are not confirmed by pressing ↵ will not be saved on power up.

Use the ⌃ ⌄ keys to adjust the selected option. Press the ↵ key to confirm your choice. The following access codes can be used to configure the pump:

Code	Description	Default	Summary
21	Enable Volume/Time Infusions	**OFF**	Select one of the two available infusion modes: (**CLoC**) **OFF**: Input a Flow Rate and Volume to be Infused (VTBI) (**CLoC**) **ON**: Input a Volume to be Infused (VTBI) and Time for infusion.
22	Maximum Priming Volume	40ml	The Maximum volume (**OFF**, 1 - 40ml) to be infused during priming sequence. Before starting an infusion, pressing the ⏩ key will initiate set priming sequence.
23	Clear Infusion Parameters to Zero on Power On	**OFF**	**OFF**: Previous infusion parameters: last rate, VTBI (and time of infusion if applicable) and volume infused are displayed on power on. **ON**: Previous infusion parameters are reset to zero on power on.
24	Maximum VTBI in MICRO Mode	999ml	Set the maximum allowable VTBI between 0.1ml and 999ml, in micro mode only.
25	Bolus Rate	400ml/h	Set the Bolus rate between 1 and 999ml/h (providing the default bolus volume is greater than zero). Pump will infuse at this rate when ⏩ key is pressed twice and held.
26	Maximum Bolus Volume	5ml	Set the maximum bolus volume between **OFF** and 99ml. Maximum volume that will be delivered whilst the ⏩ key is held down during an infusion.
27	Keep Vein Open (KVO) Rate	5ml/h	Set the Keep Vein Open (KVO) rate (**OFF**, 1.0 - 5.0ml/h). At the end of the infusion, the pump can either stop pumping or continue infusing at a Keep Vein Open (KVO) rate.
28	Single Bubble Alarm Volume*	100µL	Set the maximum size of air bubble (50µL, 100µL, 250µL, 500µL) that can be passed through the pump without causing an alarm.
30	Enable Secondary Infusions	**OFF**	**OFF**: Disable automatic secondary infusions. **ON**: Enable automatic secondary infusions.
31	Default Occlusion Pressure	**Hi**	Set the default occlusion alarm value (**Lo**, **Normal** or **Hi**) at power-on.
32	Alarm Volume Level	4	Set alarm volume level between 1 (low) and 7 (high).
35	Enable MICRO Mode	**OFF**	**OFF**: Standard infusion mode. **ON**: Enable micro mode.
36	Maximum Infusion Rate	999ml/h	Set the maximum infusion rate between 1 and 999ml/h.
38	ASCII Mode Comms	**OFF**	**OFF**: Disable ASCII communications mode. **ON**: Enable ASCII communications mode.
39	Odd Parity Comms	**OFF**	**OFF**: Disable odd communications parity bit generation. **ON**: Enable odd communications parity bit generation.
40	Pump Address Comms	1	Set pump address used for communications (1 to 250).
41	Flow Sensor Connection Mode	**AUTO**	**AUTO**: Pump automatically detects flow sensor if connected. **ON**: Pump will only operate with a flow sensor connected.

Code	Description	Default	Summary
42	Set-up of Current Time and Date		Set current time (00:00 to 23:59), and date (01/01/00-31/12/99) for event logging. Does not automatically adjust for Summer time.
44	Language Selection	**EnGL**	Set language used (**EnGL**, **dEut**, **FrAn**, **ItAL**, **ESPA**, **nEd**, **SE**). **NOTE:** See Language Selection section for identification of language to configure.
45	IrDA Communications Selection	**ON**	**OFF**: RS232 comms enabled. **ON**: IrDA comms enabled.
46	Nurse Call Activation	**ON**	**OFF**: Disable activation state of the nurse call (active low output from pump). **ON**: Enable activation state of the nurse call (active high output from pump).
47	Drops per ml of Fluid	20	Select number of drops per ml of fluid (1 to 200). Defined by the type of set. Reference the packaging of IV infusion set.
48	Silent Mode	**OFF**	**OFF**: Audible response to a key press is given. **ON**: No audible response to a key press is given.
49	User Select Mode Configuration: • Pressure Limit Enabled • Alarm Volume Enabled • Timed Infusions Enabled • Micro Infusions Enabled	**OFF**	**OFF**: Disable mode. **ON**: Enable mode.
50	Flow Sensor Sensitivity Level	**nor**	**nor**: Normal sensitivity. **Hi**: High sensitivity.
200	Reset all configurable options to default	-	Resets all configurable options to factory default.
201	Reset EEPROM data	-	Reset EEPROM data code to a defined state if EEPROM checksum error. **NOTE:** The pump will need to be returned to factory for reconfiguration if this option is used.
202	Repair EEPROM data	-	Detects and repairs any corrupted memory segments, resetting any repaired areas back to the factory defaults. **NOTE:** The pump will need to be returned to factory for reconfiguration if this option is used.

Before making any amendments to configuration settings:

Care should be taken to document existing configuration settings to enable changes to be reverted if required. Configuration requirements may vary from ward to ward therefore care should be taken to ensure any configuration settings are appropriate for the ward concerned and users are aware of any changes to configuration settings prior to use.

Subsequently, sharing of Alaris® GW Volumetric Pumps between wards may be inappropriate.

Note: *Single Bubble Alarm Volume Although an individual bubble may not exceed the pre-programmed threshold, the accumulative volume of bubbles, in a 15 minute window, may be sufficient to initiate an air-in-line alarm, indicated by an **Air OCCL** message.

Teach Learn (Software Versions V5R1F and above)

1. For both the teach and learn pumps in Technician Mode enable IrDA communications (Code **45**), and ensure that ASCII / Binary mode and parity bit options (Codes **38** and **39** respectively) are the same.
2. Turn the teaching pump on in normal operation. Note: For multiple teach-learn operations, to avoid call-back alarm every 2 minutes, turn the teaching pump on in Technician Mode.
3. Enter Technician Code **67** on the learning pump.
4. Align the two IrDA ports on the pumps (optimum distance 50 mm).
5. Depress the ↵ key to initiate learning.
6. A progress bar will travel across the learn pump.
7. When successful, the learn pump will display **PASS**.
8. If the learning pump is unable to learn all configuration parameters then the display will show **ConF** followed by a list of the configuration parameters that could not be learnt; these will instead contain the factory default settings. This could occur if, for example, the software version of the learning pump is newer than that of the teaching pump.

Possible Reasons for failure

- **IrDA not enabled on both pumps;**
- **ASCII / Binary and parity bit options are not the same;**
- **If the software versions are not compatible;**
- **If the pump models are different;**
- **The line of sight between the IrDA windows was obstructed during data transfer.**

Language Selection

Language codes

Language codes available are:

EnGL	English
dEut	German
FrAn	French
ItAL	Italian
ESPA	Spanish
nEd	Dutch
SE	Swedish

Language code to be used is dependent upon the pump SKU, refer to table below.

SKU	EnGL	dEut	FrAn	ItAL	ESPA	nEd	SE
25041ESD1					✓		
25041GBD1	✓						
25042NLD1						✓	
25042GBD1	✓						
25042FRD1			✓				
25042DED1		✓					
25042ITD1				✓			
25042PTD1	✓						
25042ESD1					✓		
25042SED1							✓
25042POD1	✓						
25042HUD1	✓						
25042RUD1	✓						
25042DKD1	✓						
25042TRD1	✓						
25042FID1	✓						
25042ELD1	✓						
25042SRD1	✓						
25042ROD1	✓						
25042SLD1	✓						
25042HRD1	✓						
25042EED1	✓						
25042LVD1	✓						

Calibration procedures

This section outlines the procedures for calibration of the Alaris® GW Volumetric Pump.

All of these calibrations should only be carried out by qualified biomedical engineers. If in any doubt about how to perform the tests, in particular the pressure sensor calibration checks, contact your local CareFusion Service Centre who will be able to assist.

Recommended Calibration Equipment

Specialised test equipment is not required for the majority of the functional tests to be carried out on the pump. In order to calibrate or verify the occlusion alarm point or volumetric accuracy, the following equipment will be necessary:

- IV infusion set, suitable for the Alaris® GW Volumetric Pump with standard Luer lock taps for connecting to other test equipment. If the standard sets are not available, it is possible to order a basic test set that is available from your local CareFusion Service Centre - part number 0000TG00074. Note that all sets should only be used for a single calibration operation.
- Pressure gauge for measuring liquid pressure, with a full scale of 0-2 bar (0-1500mmHg) ±20mmHg.
- Either:
  - Class A 50ml glass burette with graduations down to 0.1ml and calibrated down to ± 0.05ml.
  - Calibrated scales accurate to at least ± 0.01g.

Volumetric Accuracy Calibration (CODE 18) The volumetric accuracy calibration routine is used for manufacture of the pump only.

Displaying the Volumetric and Pressure Calibration Values (CODE 2)

Use of this access code simply displays the calibration values stored in the software.

9. Enter the access code **2**.
10. Press ↵ to step through all Cal values.
11. Switch the pump OFF if there are no further tests to be done at that time.

Battery Calibration (CODE 4)

The pump must be connected to the AC power source throughout the duration of the test. The test can be aborted at any time by switching the pump off using the ⏻ key; no change is made to the battery low point calibration value stored previously in the pump. This calibration should only be performed on a fully charged battery. Ensure the pump is plugged into the mains for at least 24 hours before starting this procedure.

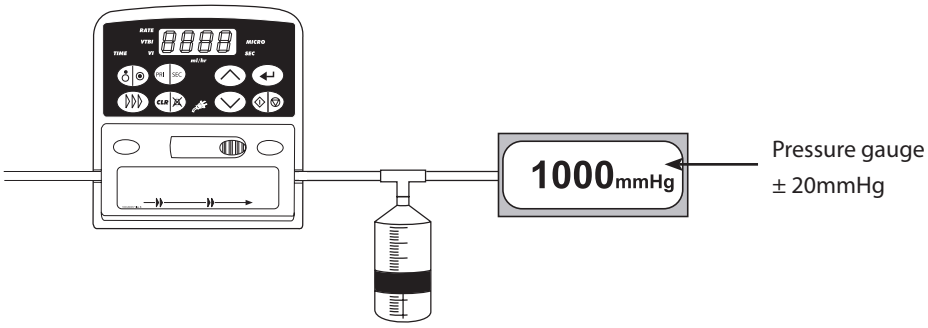
1. Plug a mains lead into the pump.
2. Prepare a fluid-filled looped tubing, load it into the pump and close the door.
3. Enter the access code **4**.
4. The test will start automatically. The pump infuses at 999 ml/h internally switching to the battery power source to discharge the battery; the air-in-line alarm is disabled. Throughout this test the time indicator will increase in minute intervals.
5. As soon as the pump detects that the battery is discharged, the time shown on the main display will stop increasing and begin to flash.
6. If the time is greater than two hours and the low point voltage value is within the allowable range of 6.5 to 7.8 volts, then the display shows **PASS** / **xx:xx** / **bx.x**, the pass indication, elapsed time and battery low point value in volts. Otherwise the display shows **FAIL** / **xx:xx** / **bx.x**.
7. Press the ↵ key. When the ↵ key is pressed, the low point calibration value will be stored.

Note: If the pump is switched off before the ↵ key is pressed, the calibration value will be lost and the test will have to be repeated. When ↵ is pressed, the pump will revert to the technical service entry mode and flash **CodE**, followed by **0**, this allows you to begin other tests. Switch the pump OFF if there are no further tests to be done at that time.

8. If the pump fails the calibration, try to charge the battery, and repeat the test. If this fails again then replace the battery and / or Power Supply Unit.

Pressure Sensor Calibration (CODE 17)

An internal pressure sensor is used to detect downstream occlusions. This sensor requires calibration whenever a new sensor, Main PCB is fitted or if door is changed or removed. It is necessary when servicing a pump, to carry out an occlusion pressure test to verify that the sensor is calibrated correctly (see self test routine in Chapter 3 Routine Maintenance). A calibrated pressure gauge will be needed in order to perform this calibration.

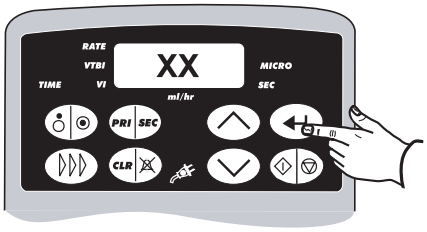


When the pressure sensor is replaced the null pressure value must be checked and adjusted, if required, prior to calibration. Check the null pressure value as follows:

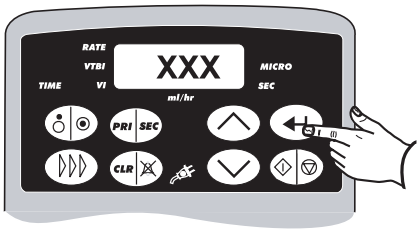
- **Enter the access code 12. Go to test 8 and press ↵.**
- **With no set loaded and door open check displayed value is 11 ±4.**
- **If the reading is outside of tolerance then adjust R2 on the Pressure Sensor PCB until displayed value is within tolerance.**

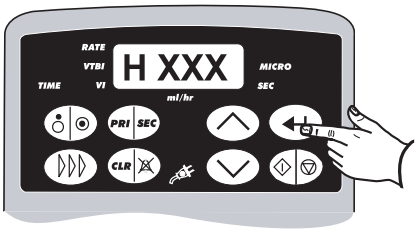
1. Load a set into the pump to be calibrated and prime the set. Connect to pressure gauge as shown in diagram above.
2. Enter the access code 17.
3. Apply pressure required for each step and when pressure required is displayed on pressure gauge for 10 seconds (allows pressure to settle) press ↵. Calibration values will be returned. Press ↵ to go to next step.

PrES step - 150mmHg ± 40mmHg

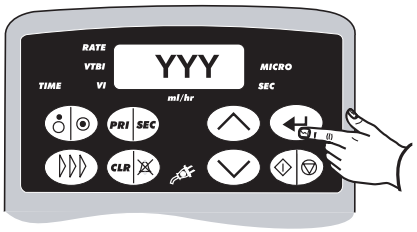


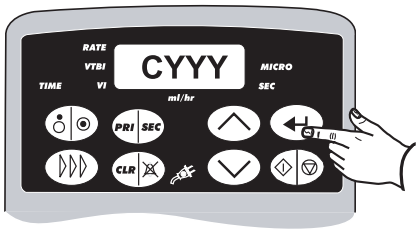
HI step - 650mmHg ± 40mmHg.



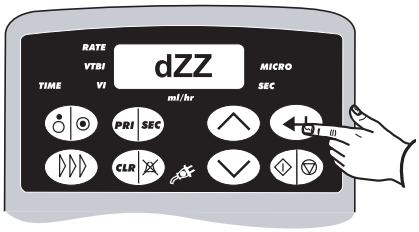


CAP step - 1000mmHg ± 40mmHg.





Difference step



XX / XXX indicates calibration values, that have no tolerance values applicable.

YYY indicates calibration values that should be between 115 and 214.

ZZ indicates a calibration value that is the difference between XXX and XX and should be between 37 and 54.

3 Preventative Maintenance

Preventative Maintenance

To ensure the pump remains in good operating condition, routine and preventative maintenance inspections are required. Routine maintenance inspections should be performed by hospital/facility before each use, see Directions For Use for details.

Preventative maintenance inspections should be performed at least every three years.

For the preventative maintenance inspection the following should be performed:

- Full visual inspection of the pump, internal and external
- Clean the pump
- Fitting of all updates required
- Battery test and/or replacement
- Performance Verification Procedures

Following all spare part replacement and repair activities, testing must be performed in accordance with the Performance Verification Procedure (PVP). Additional testing and calibration may be required after certain repairs are completed, see table in Chapter 6 'Corrective Maintenance' for more information.

Visual Inspection

Open the pump, as per Chapter 6 'Corrective Maintenance' and visually inspect the interior of the pump.

Visually inspect the exterior of the pump checking the following:

- Labels should be replaced as required if not flat, legible or fully adhered.
- Check Keypad label for any sign of wear and replace as required.
- Case components must be checked for damage and replaced if necessary.
- Check the pole clamp is not damaged and that it functions correctly.
- Inspect the AC power supply plug and cable for damage.
- The case should be clean and free from IV solution residue, especially near moving parts.
- Check for dried solution deposits on accessible areas of pumping mechanism.

Cleaning and Storage

Cleaning the pump

Before the transfer of the pump to a new patient and periodically during the use, clean the pump by wiping over with a lint-free cloth lightly dampened with warm water and a standard disinfectant / detergent solution.

Do not use the following disinfectant types:

- Disinfectants which are known to be corrosive to metals must not be used, these include:
  - NaDcc (such as Presept),
  - Hypochlorites (such as Chlorasol),
  - Aldehydes (such as Cidex),
  - Cationic Surfactants (such as Benzalkonium Chloride).
- Use of Iodine (such as Betadine) will cause surface discoloration.
- Concentrated Isopropyl alcohol based cleaners will degrade plastic parts.

Recommended cleaners are:

Brand	Concentration
Hibiscrub	20% (v/v)
Virkon	1% (w/v)

The following products were tested and are acceptable for use on the Pump if used in accordance with the specified manufacturer's guidelines.

- Warm soapy water
- Mild detergent in water (e.g. Young's Hospec)
- 70% Isopropyl Alcohol in water
- Chlor-Clean
- Clinell Sporicidal wipes
- Hibiscrub
- TriGene Advance
- Tristel Fuse sachets
- Tristel Trio wipes system
- Tuffie 5 wipe
- Virkon Disinfectant
- Virusolve+ (Ready To Use)
- Virusolve+ (Wipes)

Before cleaning always switch off and disconnect from the AC power supply. Do not allow liquid to enter the casing and avoid excess fluid build up on the pump.

Do not use aggressive cleaning agents as these may damage the exterior surface of the pump. Do not steam autoclave, ethylene oxide sterilise or immerse this pump in any fluid.

Cleaning the Flow Sensor

Before the transfer of the flow sensor to a new Infusion set and periodically during use, clean the flow sensor by wiping over with a lint-free cloth lightly dampened with warm water and a standard disinfectant / detergent solution. Ensure the connector does not get wet. Dry flow sensor before use.

To aid cleaning of flow sensors which have been heavily soiled, contaminated or if the handle operation is not free moving, then the flow sensor may be immersed and soaked in clean soapy water (see). The inside of the spring mechanism can be cleaned by activating it whilst submerged in the water.

After cleaning, the sensor should be allowed to dry fully prior to use.

The plug of the flow sensor must not be immersed in water as damage will occur.

Storage

If the pump is to be stored for an extended period it should be cleaned and the internal battery fully charged. Store in a clean, dry atmosphere at room temperature and, if available, employ the original packaging for protection.

Once every 3 months during storage, carry out functional tests as described in this chapter and ensure that the internal battery is fully charged.

Please note during long term storage of the pump the Real Time Clock circuitry is being maintained by BT1 on the control PCB. Under long term storage conditions it is recommended that the pump is powered in Technician Mode for a period of 24 hours so as to keep the BT1 charged, and eliminate the possibility of depleting BT1 and inducing Err9 faults at power up.

Updates

Upgrading firmware

The optional upgrade of the Alaris® GW Volumetric Pump software to V5R1F should be considered at the next product service for all Alaris® GW Volumetric Pumps fitted with software version V4R2C. Perform upgrades by acquiring the software upgrade kits specified in the spares parts listings. Note: when upgrading Alaris® GW Volumetric Pumps from software version V4R1B, first install the V4R2C software upgrade kit to enable the flash upload capabilty.

For installation of software version V4R2C contact your local CareFusion representative. This software version is not available as a spare part.

The major features of the V5R1F software include:

- Teach / Learn Capability;
- Additional configuration options:
  - Silent Mode;
  - SELECT Mode Options;
  - Drop Sensor Connection Mode;
  - Drop Sensor Light Sensitivity Level;
  - Alarm volume level factory default now 4 (was 7);
  - Clear Infusion Parameters to Zero default now **OFF** (was **ON**).
- Additional Technician Mode Configuration options:
  - New Volumetric Calibration Mode to reduce calibration time (Code **19**);
  - New EEPROM Memory Management to improve work with Teach / Learn and to eliminate need to recalibrate pumps following firmware upgrade (Codes **200**, **201**, **202**).
- Automatic setting of VTBI to **OFF** when used with drop sensor;
- Elimination of FLo SEnS error in HoLd Mode resulting in nuisance alarms;
- VI now cleared in HoLd Mode and retained upon power down.

Recalibration is not required when upgrading from software version V4R2C, although all configuration parameters will be returned to factory defaults.

- PC Requirements
  - Microsoft Windows 95, 98, 2000 or NT operating system
  - 9pin D-type PC serial port or IrDA port.
- Tools required
  - CD-ROM 1000SP00493 - Alaris® GW Volumetric Pump Software Distribution Disk V5R1F
  - Programming Kit 1000SP00172 (Suitable for all Alaris® Infusion Pumps) or RS232 Cable 1000SP00336

1. Load the software program onto your PC from the Distribution Disk.
2. The CD should automatically load. If not, access the drive and run 'SETUP'.
3. Follow the on screen InstallSheild Instructions.
4. Select the Alaris LVP SMU icon (WinSmug)
5. Place the infrared programming device approximately 50mm directly behind the IrDA window on the rear case or connect the RS232 cable to the 9 pin D type serial port connector situated on the side of the pump.
6. Select the appropriate port (e.g. COM1) on the Alaris LVP SMU program and Press 'Upload'.
7. Briefly depress the key on the pump to be upgraded; the pump will now display **PROG**.
8. Switch the pump on for normal operation when the upgrade is complete. If required, the pump will display tESt whilst automatically completing a test sequence during which the EEPROM memory will be re-partitioned.
9. When the upgrade is complete, enter the Technician Mode and verify the correct software version has been installed; initiate a factory Reset (Code **200**).
10. Perform the Self Test checks (Code **3**).

Power failure. Power failures may occur when using laptops when communicating with the Alaris® GW Volumetric Pump due to power requirements. External power may be used in conjunction with IrDA or RS232 to compensate for lack of power from the laptop.

Bright sunlight and strong fluorescent lighting affect the Infrared programming system. If any errors are reported then the RS232 method of upgrading the software should be used.

Complete and return the 'Software Upgrade Record' in the 'Appendix' section after performing any software upgrade.

Battery Test and Replacement

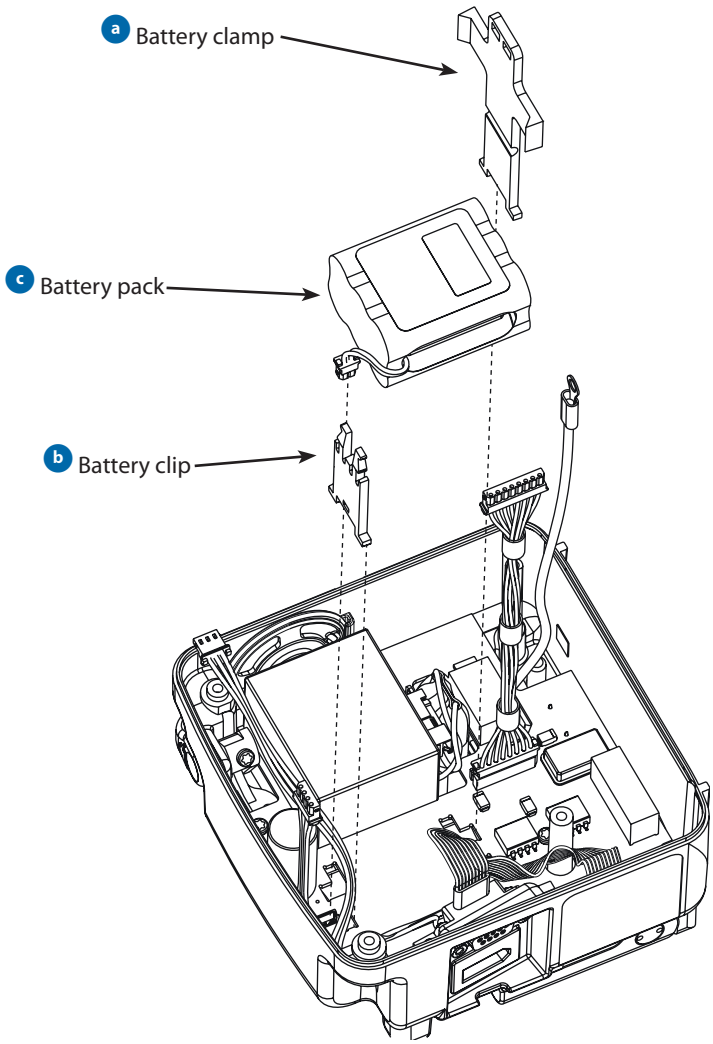
To test the battery perform the battery calibration, as outlined in the procedure in Chapter 2 'Configuration and Calibration', and verify that all pass criteria are met. If pass criteria are not met then replace the battery.

Battery charge retention will eventually degrade. So where retention is critical the internal battery should be replaced every three years.

Replace the Main Battery

It is recommended that the battery is replaced at least every 3 years, in order to guarantee maximum backup battery time.

1. Separate the two case halves.
1. Remove the small plastic clamp and clip that holds the battery in place. Unplug the battery from the PSU and Comms. PCB and remove the battery from the rear case.
2. Re-assemble in reverse order.



The battery pack used in this Alaris® Volumetric Pump is manufactured by CareFusion and includes a proprietary PCB (printed circuit board) designed specifically for the Alaris® Volumetric Pump, and in conjunction with Alaris® Volumetric Pump software, controls battery use, charge and temperature. Any use of battery packs that are not manufactured by CareFusion in the Alaris® Volumetric Pump is at your sole risk, and CareFusion does not provide any warranty for or endorsement on any battery packs that are not manufactured by CareFusion. CareFusion's product warranty shall not apply in the event the Alaris® Volumetric Pump has suffered damage or premature wear, or malfunctions or otherwise operates incorrectly, as a result of use with a battery pack that is not manufactured by CareFusion.

Test procedures

Important Service Information:

Testing and Calibration of Volumetric pumps is very dependent on the tubing set used. For this reason, a new set of tubing should be used for each pump tested, and the tubing should be thrown away once all tests are completed. Recommended test set is part number 0000TG00074.

Entering Access Codes (Technician Mode)

Note: See Chapter 2 'Configuration and Calibration' for information on how to enter access codes

Code	Test	Description	
1	Input a pump reference number, and service date	This enables the user to put in their own 4 digit reference number or asset number, together with the date the pump was last serviced in the format Wk:Yr (15:01) week 15 of 2001. Defaults to 0 and 0:00.	
2	Display volumetric, pressure calibration and battery Cal values	Reference only, 4 values shown: CAL - 20.00 if pump has not been calibrated (range 16-24) Pres - DXXX delta value, (range 36 to 55, default to 46) CAP - CXXX Maximum value, (range 110 to 219, default 163) bAt - bx.xx (range 6.44 to 7.86, default 7.15)	
3	Main Self Test	See Self Test Routine Table.	
4	Automatic Battery Maintenance/ Discharge Test	Takes approximately 2-5 hours, if it takes less than 2 hours it will display 'fail' The pump will then switch to charging, it is recommended this be done for 24 hours.	
5	Volumetric Accuracy Verification Test	See Volumetric Accuracy Verification Test (code 5) detailed description in this document.	
10	Alarm history log	This will show the last 10 error/alarm codes Use the e key to step through.	
11	Display current time and date	-	
12	Access to individual tests within the Main Self Test	**Note:** Not in Sequential Test (code **3**), available only through code 12.	
		Test Nr.	Description
		9	EEPROM Checksum Test. Display two 16-bit EEPROM check sums. During power up the processor calculates EPROM checksums values and checks them against those stored, if a difference is detected a corruption in data has occurred.
		11	Pumping Mechanism Test. This test disables the pressure, door and AIL sensors. The pump will pump into a pressure gauge and display the pressure reached, this is exited by pressing the enter key.
		12	Bubble Measurement Test. This displays the size of the air bubble detected in microlitres.
17	Pressure Calibration	Refer to Chapter 2 Configuration and Calibration.	
18	Volumetric Calibration	This is a manufacturing code, volumetric calibration should not be carried out.	
19	Reduced Volumetric Calibration	This is a manufacturing code, volumetric calibration should not be carried out.	
67	Learn configuration settings	See Teach Learn procedure.	

Self test routine

Enter access code **3**. Press the ↵ key to advance to next test.

Level	Test	Description
1	Keypad Test	Confirm display indicates correct button pressed. When level is entered the display will show "b-1", press buttons 1 to 8, after pressing button 8 the test will automatically proceed to level 2.  b-1 b-2 b-3 b-4 b-5 b-6 b-7 b-8
2	Display Test	Check all LEDs. The pump will run through a count-up series to illuminate each segment of the 7 segment LEDs, and cycle through all of the green LEDs. Confirm all LEDs are working. At the end of this test all LEDs will illuminate. Press the ↵ key to advance to level 3.
3	Alarm Test	Confirm the alarm is working and a distinctive change is heard between volume levels. Pump displays 'ALAR' and alarms for 0.5 seconds at each volume (1 to 7). Press the ↵ key to advance to level 4.
4	Door Test	Confirm the change of state between door open (d-0) and door closed (d-1). Press the ↵ key to advance to level 5.
5	Air Sensor Test	Confirm the change of state between an air filled set (a-0) and a fluid filled set (a-1). Press the ↵ key to advance to level 7.
7	Motor Opto Test	Displays **PASS** or **FAIL**. Confirm displays **PASS**. The pump runs the motor forwards a turn, then backwards a turn. The processor checks that it sees both motor optos come on at the correct time. Press the ↵ key to advance to level 8.
8	Occlusion Pressure Test	Test requires a calibrated pressure gauge. Connect the pump IV Infusion set to the pressure gauge via a 3 way tap. Press the ⏩ key for 10 seconds. Press the ↵ key, the pump will run at 125ml/h and the display will show the current pressure sensor reading 'xxx'. After 10 seconds close off the 3 way tap so that the pump delivers into the pressure gauge. Confirm that an alarm occurs and a **h** appears on the pump display. The pressure displayed on the pressure gauge should be 500 mmHg +/- 150 mmHg. Carry out the next test or press the ↵ key to advance to level 10.
10	Drop Sensor Test	Check for correct drop count. This test counts the number of drops detected, if the sensor is not present then **Off** will be displayed.

Volumetric Accuracy Verification Test (CODE 5)

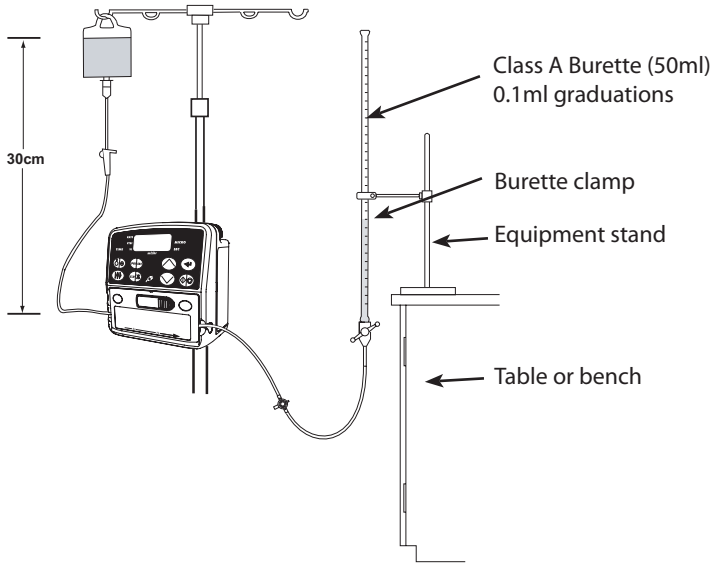
Important Notes:

- **The balances need to be switched on for 30 minutes prior to use to enable the electronics to warm up and settle.**
- **Always use new test tubing for each test. If the test ever has to be repeated, a new set of tubing must be used.**
- **Do not move the desk during testing, it will upset the balance readings.**

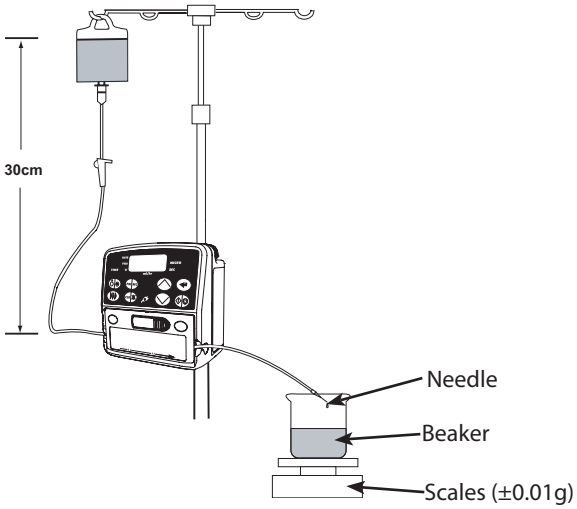
This test is used to confirm that the pumping accuracy of the system as a whole, including the tubing, is within the specified limits.

In the most controlled conditions, a needle should be used to pump liquid into the weighing beaker to prevent liquid touching the sides of the beaker and to provide some back-pressure so that leaks/overflows do not affect the readings. As a result of these and other errors, if the system fails just marginally, it is worth performing the test a second time. If it still fails, return the pump to your local CareFusion Service Centre for further analysis. The head height on IV infusion set should be approximately 30cm.

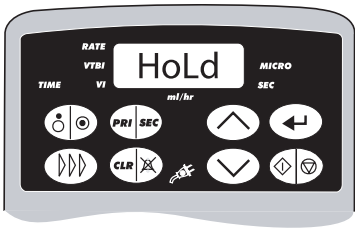
Setup A



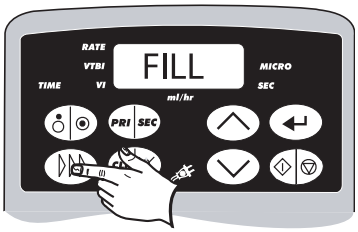
Setup B



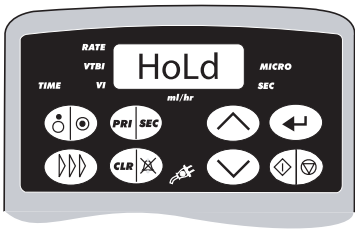
Enter access code **5**. The pump will initially display HoLd.



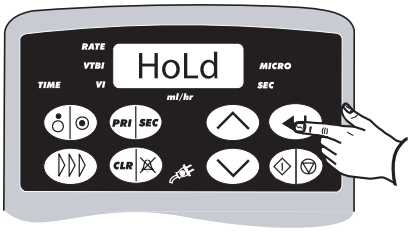
If it is necessary to prime the set, press and hold the ⏩ button. The pump will display FILL and allow the set to be primed, ignoring any air-in-line alarms.



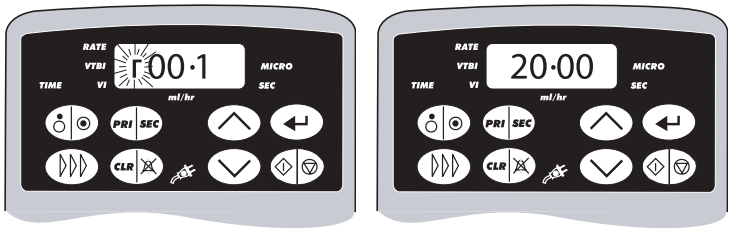
Release ⏩ once the set is primed and the pump will again display HoLd.



Zero scales or burette. Press ↵ to begin the verification check.

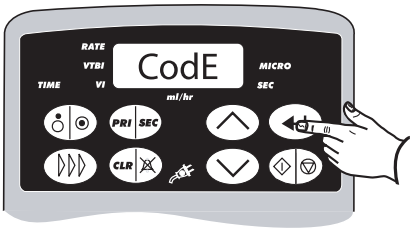


The pump will automatically pump at 125ml/h for a total of 20ml, which will take approximately 9½ minutes. During the run, it will display the volume infused up to that point and intermittently flash **r** with the run indicator, to show that this is a verification run. At the end of this run, the pump should display **20.00** and **wait**.



Allow the scales to settle and then note the reading on the scales. If using a burette, take the final reading of volume infused. The volume infused should be 20.70ml ± 5%.

Press the ↵ key and the pump will revert to the technical service entry mode and flash **CodE**, followed by **0**, enabling you to begin other tests if required. Switch the pump OFF if there are no further tests to be done at that time.



Flow Stop Mechanism Test

It is necessary to check that the flow stop device can hold sufficient pressure and thus prevent free flow.

Load set into the pump. Use same setup as for pressure calibration (see Chapter 2 Configuration and Calibration).

Open the door and check that the arm stays in the UP position by lifting the arm onto the ledge.

Close the door fully.

Reopen the door and note that the flow stop arm has activated into the down position.

Pull the test tubing out of the pump and place the tube in front of the flow stop mechanism arm in the down position.

Close the door and reopen the door. Check the tubing locator has loaded the tube fully under the clamp and is flat. This checks whether the tubing locator is the correct way around and works.

Ensure the door is open and the flow stop is closed. Apply 650mmHg to the distal end of the IV infusion set for 10 seconds. Then reduce pressure to 500mmHg to the distal end and verify pressure gauge reading is 500mmHg. Ensure the pressure does not drop by more than 15mmHg in 30 seconds.

Performance verification procedure

Model / Serial Number:		Service Order / Inventory Number:	
Hospital Name / Reference:		Software Version:	
Physical Inspection and Clean			
Recommended When Serviced Updates	Update Ref.	Fitted ✓	Not fitted / Not Applicable ✓
• Grease the pumping mechanism with Molykote PG54.	TSM		
• Upgrade to software version V5R1F or above.	TSM		
Set/Confirm time and date - access code **42**			
Set service date - access code **1**			
Check all functions in Self Test - access code **3**			
During standard infusion check the following: • KVO Operation • Flow-stop mechanism test			
Alarms Functionality Check • Door , AIL (OCC/AIR), Upstream Occlusion (OCC/AIR), Power fail, Time Out, Downstream Occlusion (HI PRESS). • Ensure pump works on battery and AC mains			
Rate Accuracy Verification Test (Automatic test in Code **5**)			
Rate set to 125ml/h, VTBI set to 20ml. Volume infused = 19.7 to 21.7ml.			_____ml
Pressure Tests (Automatic test in Code **12** test 8)			
• Pump set to alarm at 500mmHg. Pressure = 350 to 650mmHg.			_____mmHg
Set Rate to Zero (or lowest value possible), Clear Volume infused and VTBI Clear Error/Alarm/Battery logs (As required)			
Electrical Safety Test Class I Type CF Test in accordance with the standard EN 60601-1 and test equipment operation manual.	Test results are stored: • Electronically ☐ • Print-out ☐ • Other ☐ _____		**PASS / FAIL**
Verification Performed By	_____ Sign	_____ Print	_____ Date
For additional information, refer to: 1000SM00006 - Alaris® GW Volumetric Pump Technical Service Manual (TSM)			

4 Troubleshooting

Event Log Download

A PC application known as the Event Log Download Utility (ELDU) is available to download the event log from the Alaris® GW Volumetric Pump.

ELDU Operation

1. Click on ELDU icon on PC.
2. Click Accept to agree with Restrictions of Use and continue;
3. Select Configure from drop-down menu;
4. Select Setup Pump and choose Alaris® GW as pump type;
5. Select Settings to select log to be downloaded;
6. Check communications are set up as follows:
   - Required PC Comm port selected
   - Character type and parity match pump configuration
7. Click OK to confirm
8. Align the IrDA converter with the IrDA window (optimum distance 50 mm), or connect an RS 232 cable.
9. Power up the pump by pressing the key.
10. Click Download log from the main PC screen.
11. Press Close when finished.
12. Select File from drop-down menu and save file. Log may be printed here as required.

Software alarm codes and displayed messages

Note: The alarm codes are intended only for fault finding and diagnostic purposes and are therefore not displayed directly to the user. The alarm history log stores the last ten alarm codes in a "first in, first out" sequence once the maximum ten codes have been exceeded.

Display	Alarm Code	Type	Description	Troubleshooting Guide
Attn			The pump has been left unattended for 2 minutes and the infusion has not started.	Press to temporarily silence for 1 minute.
boL			A bolus is being administered.	boL display replaced with a volume counter during infusion.
ErrA	-	N	Communications failure with external memory.	Replace the Control PCB.
Errb	-	N	Fatal micro-controller failure.	Replace the Control PCB. If pump does not subsequently power up, replace the pressure sensor / encoder assembly.
End			Indicates end of infusion.	Re-program the VTBI to resume infusion.
Err	1	N	Motor controller is out of bounds.	Check the mechanical parts around the gears / encoder for obstructions.
bAt	2	N	Internal battery depleted / disconnected.	Charge pump for 12 hours, check mains, battery fuses and battery.
Lo bAt			Battery voltage threshold of 7v reached. approximately 30 minutes of running time left.	Charge pump for 12 hours, check mains, battery fuses and battery.
Air OCCL	3	R	Upstream occlusion/air-in-line.	Check AIL sensor function.
HI PrES	4	R	Downstream occlusion IV line pressure exceeds limit threshold.	Check pressure and recalibrate.
HoLd			Indicates the pump is on hold.	Audible alarm after 2 minutes.
door	5	R	Door is open whilst pump is infusing.	Check door magnet or sensor is flat against case.
bAd SEt	6	R	IV set used fails automatic set test (incorrectly loaded).	Check the function of the pressure sensor.

Display	Alarm Code	Type	Description	Troubleshooting Guide
Err	7	N	Pressure sensor failure.	Replace pressure sensor/encoder assembly. If error recurs, replace the Control PCB.
Err	8	N	Power failure on AC power.	Check cables around the power connector to Control PCB. Ensure battery is connected. Check PSU Comms PCB and replace if necessary. If error recurs replace Control PCB.
Err	9	N	Safety circuit supply failure.	Ensure JP12 is firmly connected. Check voltage on real-time clock battery. If low, power-up in technician mode to recharge whilst connected to AC mains. If problem persists, replace the Control PCB.
Err	10	N	Motor is idle at very low infusion rates.	Check around the motor assembly, check for loose wires.
Err	11	N	Motor controller drive voltage limit exceeded.	Check for mechanical obstruction around the gear area. Check cabling to motor. Apply grease to pumping finger cams as per Chapter 6. Replace the pressure sensor / encoder assembly, if necessary. If error recurs, replace the Control PCB.
Err	12	N	Incorrect number of encoder steps/ revolutions.	Check for damaged/distorted motor encoder wheel. Replace the pressure sensor/encoder assembly, if necessary. If error recurs, replace the Control PCB.
Err	13	N	Encoder rotation time incorrect for set rate.	Withdraw the pump from service and ensure it is inspected by a qualified service engineer.
Err	15	N	Micro-controller stack overflow.	Replace Control PCB.
Err	16	N	Communication failure with external real time clock (RTC).	Replace Control PCB.
Err	19	N	Hardware initiated motor brake.	Replace Control PCB. If error recurs, replace the pressure sensor/encoder assembly.
Err	20	N	No. of encoder revolutions too high.	Withdraw the pump from service and ensure it is inspected by a qualified service engineer.
Err	21	N	No. of encoder revolutions too low.	Withdraw the pump from service and ensure it is inspected by a qualified service engineer.
Err	24	N	Time base difference.	Ensure JP12 is firmly connected. Replace the Control PCB if necessary.
Err	28	N	Watchdog timeout.	Replace the Control PCB.
Err	29	N	Keypad failure.	One or more of the keypad switches on the Control PCB is faulty. Replace the Control PCB. Note: may also be caused by pressing an invalid key during power-up. If this case, there is no fault.
Err	30	N	Calibration data out of bounds.	Reset pump with code 200 and recalibrate. Replace the Control PCB if necessary.
Err	31	N	External memory checksum	Replace the Control PCB.
Err	32	N	Software execution error.	Replace the Control PCB.
FLo SEnS	33	R	Flow sensor error.	Occurs if flow sensor is connected or disconnected whilst pump is infusing, or if the flow sensor is disconnected and the VTBI is off.
FLo Err	34	R	Flow error. Gross over / under infusions, bag empty, or flow detected when not infusing.	Check set, fluid and correct loading. Check flow sensor and connection to pump.
Err	35	N	Pump not calibrated.	If a new Control PCB is fitted, calibrate pressure and battery and perform a volumetric verification accuracy test. Otherwise, withdraw the pump from service and ensure it is inspected by a qualified service engineer.
Err	36	N	Logic error (invalid RTC data update during infusion).	Replace the Control PCB.
Err	38	N	7-segment LED display failure.	Replace the Control PCB.
Err	39	N	Audible alarm failure.	Check cable to speaker. Replace the Control PCB if necessary.
Err	40	N	Critical variable corruption.	Replace the Control PCB.

Display	Alarm Code	Type	Description	Troubleshooting Guide
Err	41	N	State invariant corruption.	Replace the Control PCB.
Err	42	N	ADC out of range.	Replace the Control PCB.
Loc On/Loc oFF			Indicates keypad panel locked/ unlocked.	Activate/deactivate by pressing ⌃⌄ for two seconds.
Sec			Pump is running in secondary operation mode.	
Fill			Pump priming IV infusion set.	

Key:

N : Non Recoverable Alarm

R : Recoverable Alarm

Alarm types

Non Recoverable Alarms

In this state the pump will stop the infusion and give an audible and visible warning to alert the user that a non recoverable alarm (registered on the pump as a Fatal alarm) has occurred. With the exception of a micro-controller (MCU) error or internal communications fault with the external EEPROM, each alarm condition is identified by a unique code, which is stored in the alarm history log each time an alarm occurs, to enable the qualified service engineer to trace the error condition. From a non recoverable alarm the user is able only to enter the POWER DOWN mode. The non recoverable conditions are defined in the alarm code table.

Recoverable Alarms

In this state the pump stops the infusion and gives an audible and visible warning to alert the user to the alarm condition, and to provide an indication of the nature of the alarm. Each alarm is identified by a unique code, which is stored in the alarm history log each time an alarm occurs to enable the technician to trace the alarm condition.

The recoverable alarms are defined in the alarm code table. After a recoverable alarm has occurred, the pump responds only to the following three actions: the user may temporarily silence the alarm for one minute by depressing the key; this action will suspend only the audible indicator, with the visual message remaining. After one minute the audible indicator will return.

The pump may be switched off directly from the ALARM mode by depressing and holding the key, to initiate the power down sequence. If the power down sequence is not completed, then the pump immediately returns to the ALARM mode and initiates the audible alarm.

To return the pump to the "HoLd" mode, the user presses the key; this action clears the alarm message on the main display and silences the audible indicator.

General fault diagnosis

		Parts to Check/Test								
		Front Case	Rear Case	Labels	Mechanism	Control PCB	Power PCB	Battery	Mains Lead	Fuses
General Fault	Dropped or damaged	✓	✓		✓	✓	✓			
	Exposed to fluids	✓	✓	✓	✓	✓	✓	✓	✓	✓
	No battery power					✓	✓	✓		
	No AC mains power					✓	✓		✓	✓
	Delivery rates out of tolerance	✓			✓	✓				

5 Circuit Descriptions

Module overview functional description

The pump is designed to be serviced generally to major assembly level. The PCBs are designed as non-serviceable items and as such, can only be replaced as complete parts.

CareFusion will make available, on request, circuit diagrams, which will assist appropriately qualified technical personnel to repair those parts of the pump which are designated by the manufacturer as repairable.

The main circuitry within the Alaris® GW Volumetric Pump is contained on three printed circuits boards - Control PCB, Power Supply and Communications PCB, and a small Pressure Sensor and Encoder PCB and additional plug in sensors.

Control Board

Microcontroller Block

All control and display functions are controlled by this part. Safety functions are spread around the pump with various parts. The controller is supported by a watchdog and power reset circuit. An EEPROM is used to store logged data for the pump. There is a battery backed real-time clock.

Power Control Block

Raw DC power is connected from the Power Supply unit to JP1 connector. In the event of the raw DC exceeding 36 volts, components form a crowbar. Components form a 12 volt Switch Mode Power Supply (SMPS). Components form a 12-volt monitor circuit for the Microcontroller. The battery is connected to pin 3 of JP1 and is constantly charged when connected to the mains. Components form a 5-volt reference voltage to the main processor. A switch mode regulator supplies 5-volts (VCC) to the pump. There are two 5-volt crowbar protection circuits.

Motor Driver

A Microcontroller I/O is used to control the motor speed. The modulated signal is smoothed to a DC voltage appropriate to control motor speed. Relay 1 is used to reverse the voltage applied to the motor. This reversal is used for some modes of operation. Safety devices stop the motor if necessary.

User Interface

Microcontroller drives the seven segment displays and the LEDs. The keyboard is scanned for key depressions .The display currents are monitored. Time division multiplexing enables complete control of a user interface display and input with the Microcontroller.

Air-in-line sensor

A phase shift oscillator drives the Air-in-Line sensor; the output of the phase shift oscillator signal is fed into a voltage controlled oscillator. The signal is transmitted through the fluid filled tubing and received by the ultrasonic sensor. The received signal is then passed through a window detector and then to a level detector and input into the Microcontroller.

Air-in-Line

Two ultrasonic transducers continuously check for the presence of air in the IV infusion set throughout the infusion. This air-in-line feature operates in two modes:

Single Bubble Detection - The pump will alarm and display Air OCCL whenever a single air bubble greater than the air-in-line volume alarm limit is detected. The alarm limit can be configured to 50, 100, 250 or 500µl. See also "Configurable Options" section of Chapter 2.

Air-in-Line Accumulation - This accumulation feature monitors the volume of air that passes through the IV infusion set by accumulating the volume of individual bubbles over a 15 minute window. The accumulation will alarm if more than 500µL of air is registered. This feature is particularly useful with infusions for patients that are highly sensitive to air (i.e., neonates, paediatrics) or when infusing products that create significant volumes of small air bubbles.

Flow sensor

The flow sensor is input into the Main Processor.

Door sensor

A Hall effect sensor detects if the door is open or closed and a Microcontroller reads the state of the sensor.

Buzzer

The Microcontroller is used to switch on the alarm (buzzer).

Audio Alarm

The input to the Audio alarm section is driven by a signal from the Microcontroller, fed into a phase shift oscillator and through an RC network to remove any DC present on the signal. The signal is amplified and drives the speaker.

Power Supply Unit and Communications Board

Power module

The selection of 115V or 230V is made via S1. The secondary is rectified to an unregulated DC Voltage. F2 is a Polyswitch resetable fuse. The raw DC is output to the Control PCB. The battery is connected via JP3, the maximum current being limited by F1.

RS232 and Nursecall

The external RS232 connection is made via JP5 where power for the 4kV isolated interface is taken from pins 4 and 7. This voltage is converted to a 5-volt supply and in turn converts the RS232 communications levels to TTL which are then sent to the Microcontroller. The Nursecall interface is controlled from the Microcontroller to energise the relay which causes the contact to change over.

IrDA Module

IrDA or RS232 is selectable. The IrDA communication signal is output from IC7.

Pressure Sensor and Encoder Board

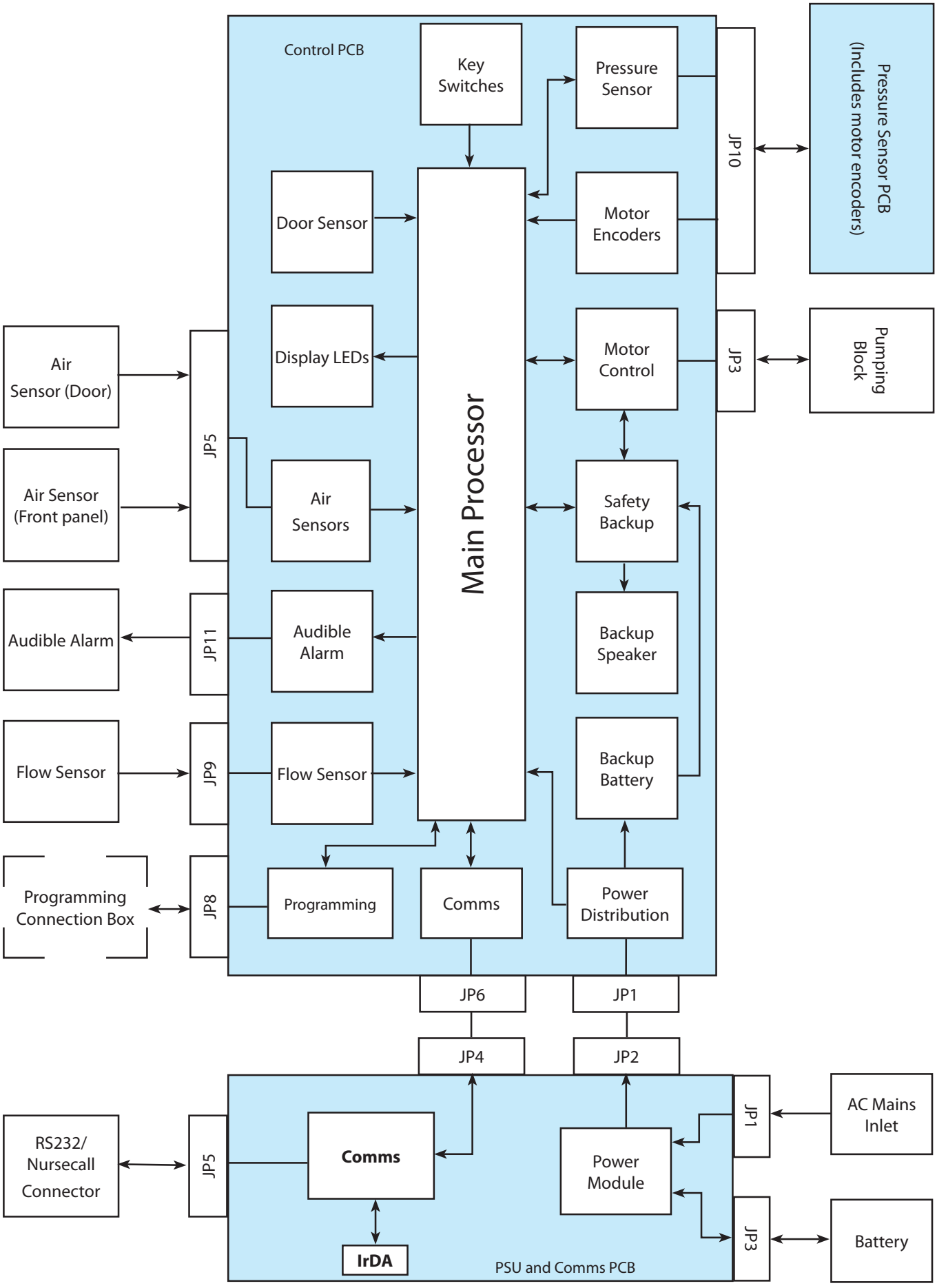
Motor encoder

Diodes D1 and D2 are the emitters in the motor encoder and OPT1 and OPT2 being the receivers. The signals are sent to the Control PCB where they are used in conjunction with the Pressure Sensor and Encoder PCB to provide a quadrature detection scheme from the rotary encoder on the drive motor. These signals are then processed via the Microcontroller.

Pressure sensor

The strain gauge is connected to the Pressure Sensor PCB, the sensor o/p signal is then amplified and then output to the Control PCB and used to provide a second stage of amplification for the pressure sensor signal. This signal is processed via the Microcontroller.

Functional module block diagram



6 Corrective Maintenance

Separation of front and rear cases

These instructions apply only to the Alaris® GW Volumetric Pumps. Ensure the pump is disconnected from AC power supply and switched off before attempting to service the pump.

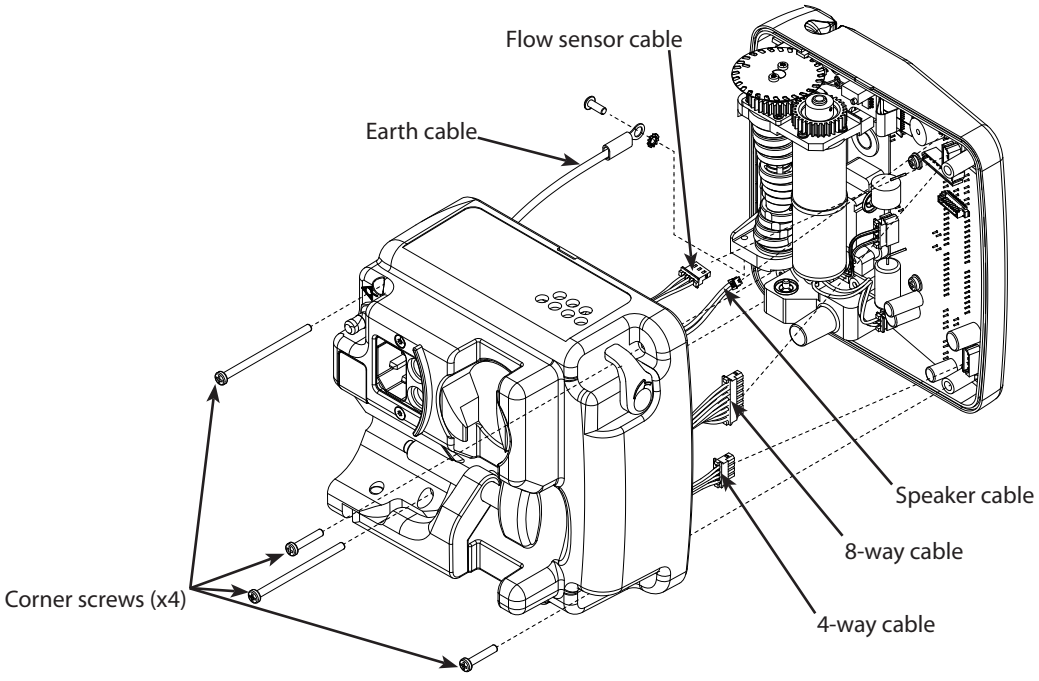
The pump contains static-sensitive components. Observe strict precautions for the protection of static-sensitive components when attempting to service and repair the pump. As a minimum, carry out all servicing on a workbench with a static dissapative surface and wear a grounded wrist strap.

Ensure that all test and calibration procedures are carried out as recommended in the service manual after any component fitting.

For fastener torque settings, refer to Appendix D Fitting and Replacement Guidelines.

For additional technical assistance, contact your local CareFusion Service Centre.

1. Remove the 4 corner screws, which secure the rear case to the front case.
2. For many subsequent operations it is possible to make all repairs with the two halves still joined, however to disassemble the two halves completely:
   a) Disconnect the four-way cable assembly that links the PSU and Comms PCB with the Control PCB.
   b) Unplug the 8-way connector from the Control PCB.
   c) Unplug the flow sensor cable and the speaker cable.
   d) Remove screw, collect washer and remove the earth connection from the Pumping block.
3. Reassemble in reverse order.



Description	Part Number	Description	Part Number
ASENA GW, KIT, FRONT CASE 230V GERMAN	1000SP00343	ASENA GW, KIT, REAR CASE 230V SWEDISH	1000SP00325
ASENA GW, KIT, FRONT CASE 230V SPANISH	1000SP00333	ASENA GW, KIT, REAR CASE 230V NORWEGIAN	1000SP00368
ASENA GW, KIT, FRONT CASE 230V FRENCH	1000SP00331	ASENA GW, KIT, REAR CASE 230V DUTCH	1000SP00340
ASENA GW, KIT, FRONT CASE 230V ENGLISH	1000SP00252	ASENA GW, KIT, REAR CASE 230V ITALIAN	1000SP00323
ASENA GW, KIT, FRONT CASE 110V ENGLISH	1000SP00327	ASENA GW, KIT, REAR CASE 110V ENGLISH	1000SP00326
ASENA GW, KIT, FRONT CASE 230V ITALIAN	1000SP00332	ASENA GW, KIT, REAR CASE 230V ENGLISH	1000SP00261
ASENA GW, KIT, FRONT CASE 230V DUTCH	1000SP00344	ASENA GW, KIT, REAR CASE 230V GERMAN	1000SP00339
ASENA GW, KIT, FIXINGS (SCREWS,WASHERS,ETC)	1000SP00489	ASENA GW, KIT, REAR CASE 230V SPANISH	1000SP00324
ASENA GW, KIT, FRONT CASE 230V SWEDISH/ NORWEGIAN	1000SP00334	ASENA GW, KIT, REAR CASE 230V FRENCH	1000SP00322

Front case assembly

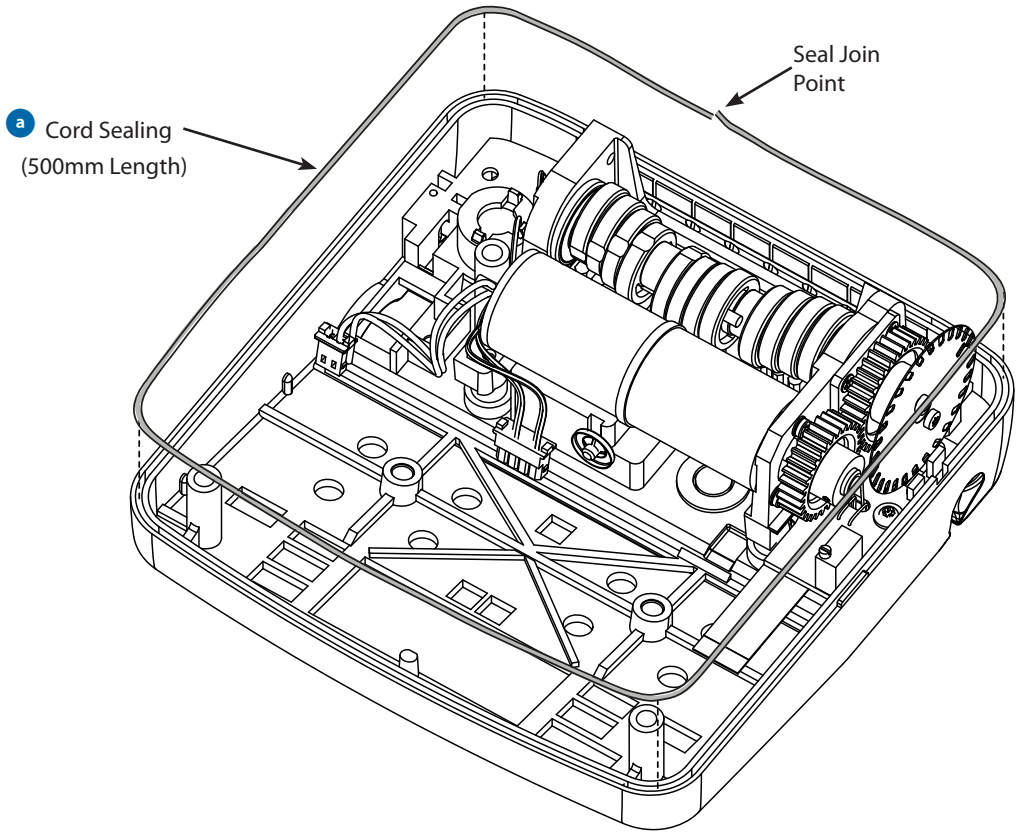
1. In order to replace a front case, it will be necessary to fully strip down the old case and insert all of the components into the new front case. The task requires a good knowledge of the pump, so be certain that you are fully conversant with all of the procedures in this section before undertaking this replacement. In order to simplify the task, new front cases are supplied with the flow stop mechanism, air sensors, and the finger and pressure sensor covers already fitted, so it is not necessary to remove these from the old case.
2. For each sub-assembly to be stripped down, follow the instructions in the relevant section of this manual. The recommended order for stripping down a front case is described below :
   - Separate the front and rear case halves;
   - Remove the Control PCB;
   - Remove the door assembly;
   - Remove the Pumping block assembly (keeping the motor on the chassis);
   - Remove the pressure sensor.
3. When re-assembling these sub-assemblies into the new case, it is advisable to simply reverse the order of dis-assembly.

It will also be necessary to apply a new front panel label, door label and flow direction label at the end of assembly. These labels are language specific. Refer to the "Spare Parts Listing" in this service manual to ensure that you order the correct label set. The part number should also be shown on the labels that were removed from the old case.

Write the serial number of the pump on the label provided and stick it onto the inside of the new case.

Case Seal

1. Remove case seal as required.
2. Reassemble in reverse order, ensuring seal join point is at base and centre of front case.



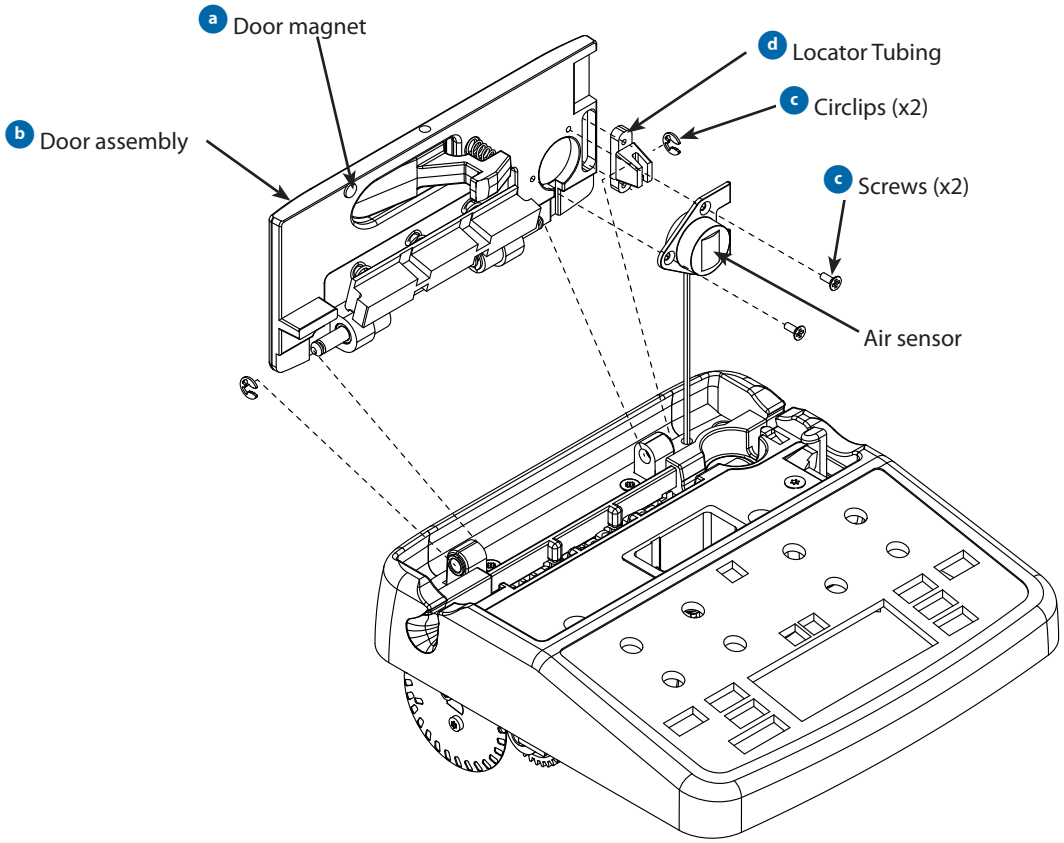
Note: Fit one length of sealing cord (1000ME01224) , available as part of kit 1000SP01652.

Item	Description	Part Number
a	GW SEALING CORD KIT	1000SP01652

Door assembly

1. Remove the air sensor assembly from the back of the door and retain the small screws for re-assembly later.
2. Remove circlips and push out the two shafts that form the hinge of the door so that they clear the first part of the hinge. Do not free the main pressure plate that is sprung on the door.
3. The old door assembly will now come free from the front of the pump.
4. Reassemble in reverse order.

When fitting the door, take care to keep the air sensor on the correct side of the door and do not crush its wires.

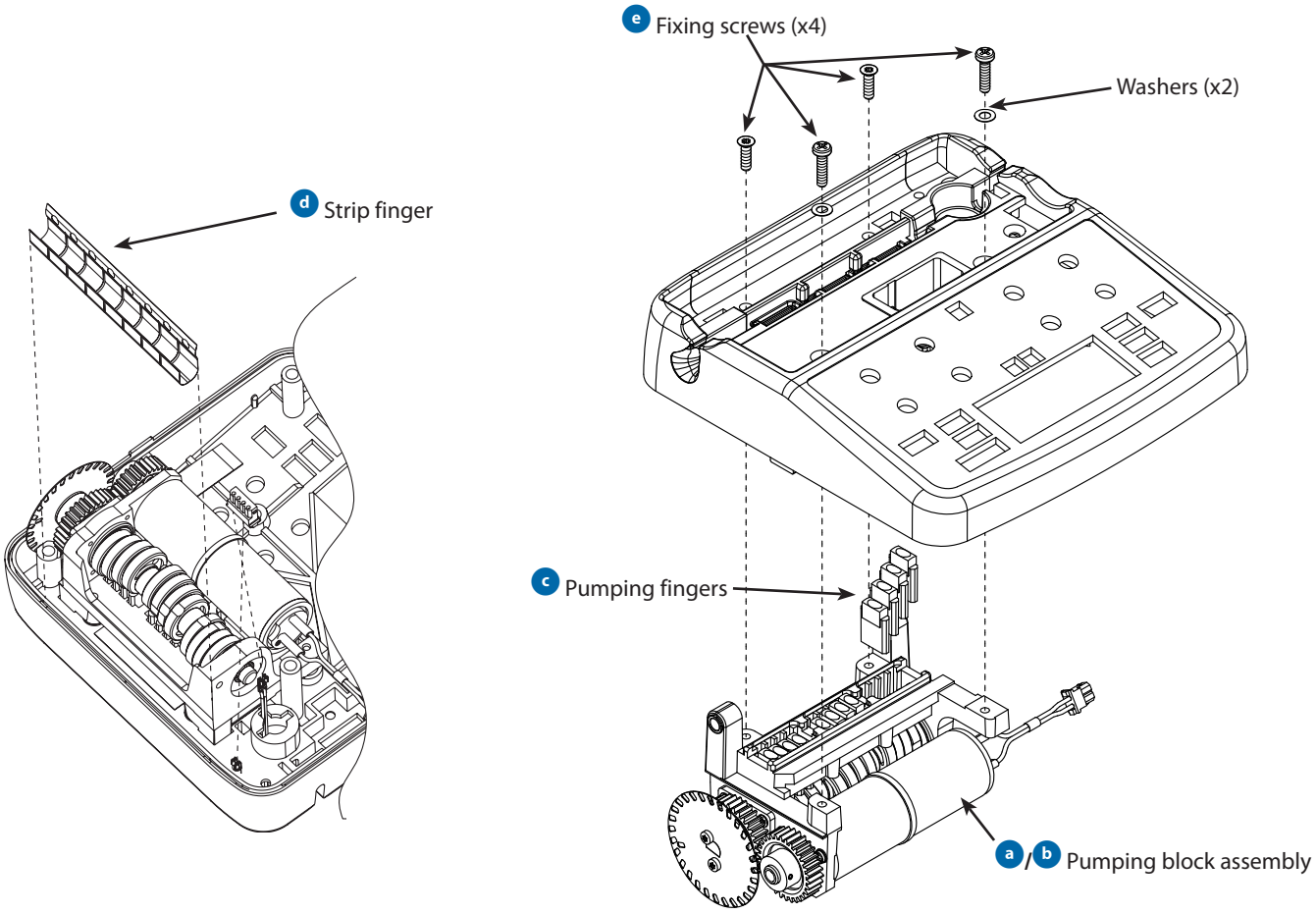


Item	Description	Part Number
a	MAGNET DOOR	1000ME01151
b	ASENA GW, KIT, DOOR	1000SP00253
c	ASENA GW, KIT, FIXINGS(SCREWS,WASHERS,ETC)	1000SP00489
d	locator Tubing Asena GW	1000ME00289
*	ALARIS GW DOOR SPARES KIT	1000SP01358

*Items not shown.

Pumping block assembly

1. Unplug the motor wiring loom from the Control PCB in the front case.
2. Remove the flow direction indication label from the front of the pump.



3. Unscrew the four screws, collect two washers that secure the pumping block to the front case, two of which are located behind the label and two that are near the door hinge.
4. It should now be possible to push out the pumping block and completely separate it from the front case. When doing this, take care not to lose any of the pumping fingers, or copper finger strip, which will be free to fall out when the main chassis is removed. Retain all of them for re-assembly later. If pumping finger(s) require replacing, it is recommended to replace all pumping fingers with new.
5. Reassemble in reverse order. Tighten the countersunk screws first, then the pan head screws. Ensure the pumping fingers are the correct way around with the narrow curved end in contact with the tubing. Fit a new flow direction label to the front of the pump.

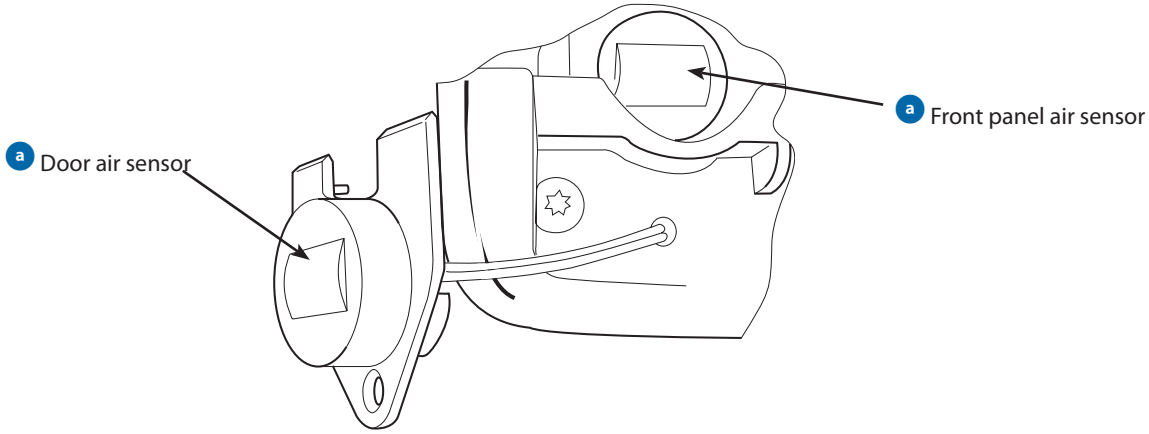
IMPORTANT: Grease should be applied when preventative maintenance is performed on the pump.

The Alaris® GW Volumetric Pump uses Molykote grease to lubricate the moving mechanical parts of the pumping mechanism to reduce the current draw of the pump. Only Molykote PG54 grease has been approved as compatible with the pump components. Each of the cams should have a thin layer applied to the circumference so that the fingers run smoothly over the cam face. The grease can be applied by a lint-free cloth or finger for example, to achieve an even layer over each cam.

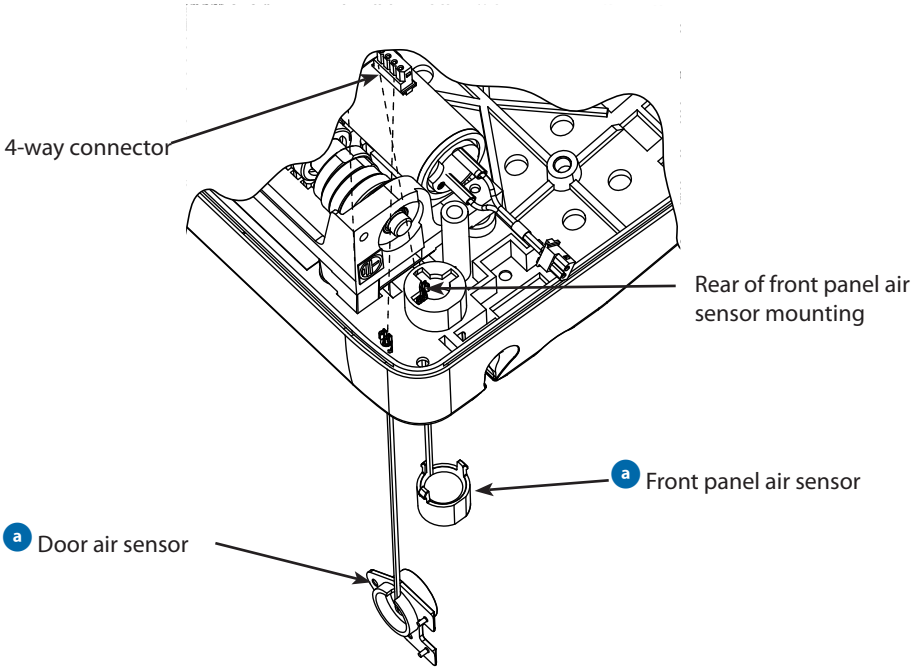
Item	Description	Part Number
a	ASENA GW, KIT, PUMP BLOCK 230V	1000SP00257
b	ASENA GW, KIT, PUMP BLOCK 110V	1000SP00329
c	GW Pumping Finger Kit	1000SP01569
d	ASENA GW, ASSY, STRIP FINGER (Be Cu)	0000EL00816
e	ASENA GW, KIT, FIXINGS(SCREWS,WASHERS,ETC)	1000SP00489

Air sensor assemblies

1. Unplug the four-way connector for the two air sensors.
2. Unscrew the door air sensor from the back of the door and pull out the two wires through the hole to free the sensor.

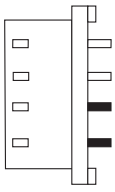


3. Carefully push out the front panel air sensor, while moving the three retaining lugs towards the centre of the sensor, by pressing gently on the encapsulated area with a screwdriver. Again, pull the two wires free from the front case.
4. Reassemble in reverse order.



The two air sensors are similar, but can easily be distinguished. The door sensor has a flange with two countersunk holes in it. The front panel sensor has three sprung clips to hold it in the case.

Insert the crimps into the four-way connector provided, as indicated by the following diagram:

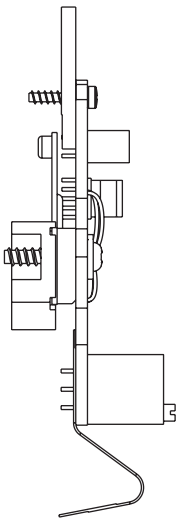


Pin 1 Door Sensor White
Pin 2 Door Sensor White
Pin 3 Front Panel Sensor Blue
Pin 4 Front Panel Sensor Blue

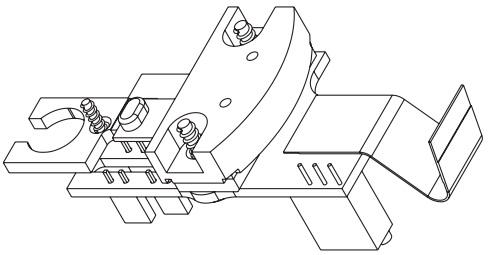
Item	Description	Part Number
a	ASENA GW, KIT, AIR SENSORS	1000SP00265

Pressure sensor assembly

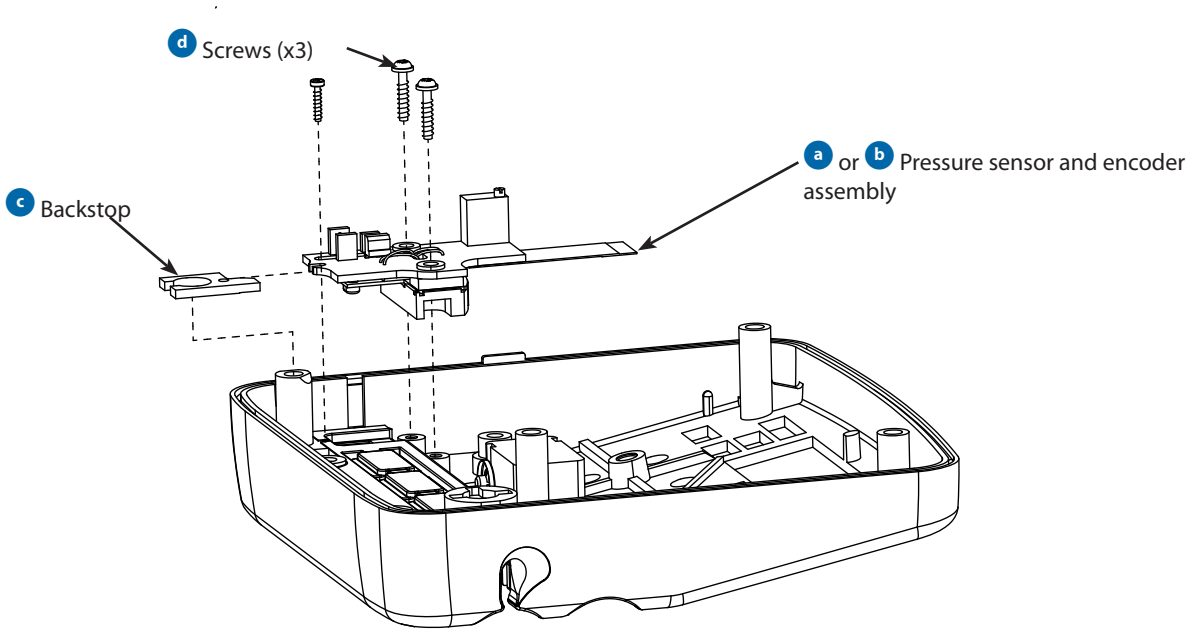
1. Remove the three screws that hold the pressure sensor assembly in place. Unplug the assembly from the Control PCB. Carefully remove the pressure sensor from the case.
2. Reassemble in reverse order. Tighten the larger 2 screws first, then the smaller screw.



Side View



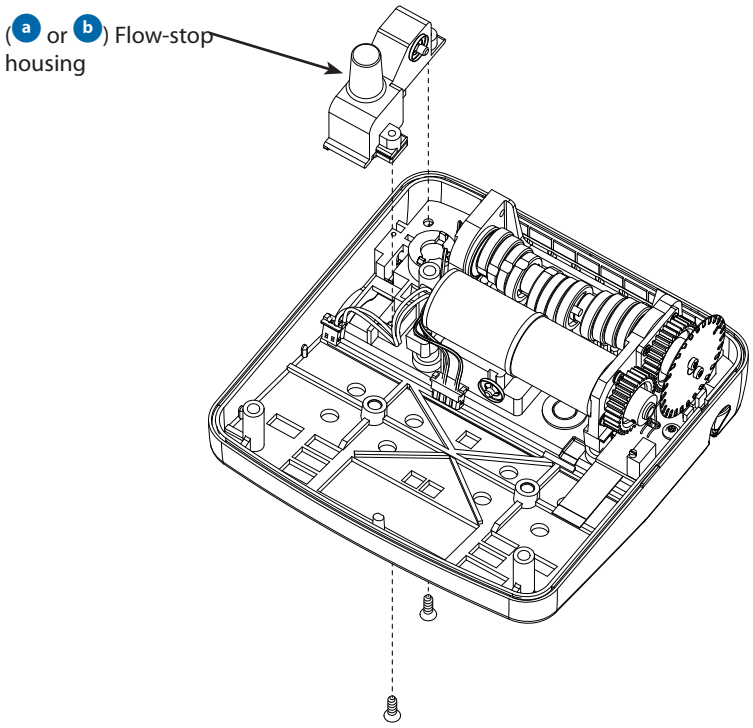
Underside View



Item	Description	Part Number
a	ASENA GW, KIT, PRESSURE SENSOR 230V	1000SP00256
b	ASENA GW, KIT, PRESSURE SENSOR 110V	1000SP00330
c	ASENA GW, ASSY, BACKSTOP/MEMBRANE CLAMP	1000ME02053
d	ASENA GW, KIT, FIXINGS(SCREWS,WASHERS,ETC)	1000SP00489

Flow-stop assembly

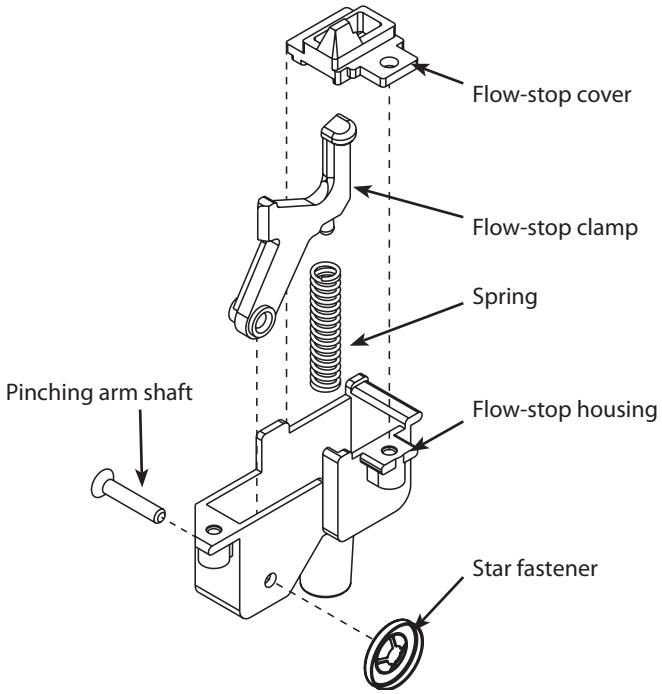
1. Remove the flow direction label to reveal one of the screws holding the flow-stop assembly. Remove the two screws that hold the flow-stop housing mechanism onto the front case and remove the whole assembly as a single item. This includes the sprung arm and the small cover that provides the locking position for the arm.
2. Assemble a new flow-stop mechanism (see instructions below), if required.
3. Reassemble in reverse order.



Fitting a new flow-stop mechanism

1. New flow-stop mechanisms are provided as a kit of parts, so it will be necessary to assemble the mechanism prior to fitting. Use the old mechanism that has been removed as a guide to this process and if necessary refer to the assembly drawings shown here.
2. Insert the flow-stop clamp into the flow stop housing and align the holes and secure them together with the pinching arm shaft and star fastener.
3. Insert the spring through the hole in the flow-stop housing. Locate the opposite end of the spring on the tag on the flow-stop clamp.
4. Fit the flow-stop cover over the top of the assembly and then refit the whole assembly back in position in the case, so that the pinch-point of the flow-stop clamp fits through the lower of the two holes.

The flow-stop mechanism (Items a or b)



Item	Description	Part Number
a	ASENA GW, KIT, FLOWSTOP MECHANISM 230V	1000SP00254
b	ASENA GW, KIT, FLOWSTOP MECHANISM 110V	1000SP00328

Control PCB

1. Unplug all of the connectors that plug into the Control PCB - i.e. the pressure sensor, the air sensors and the motor wiring loom, as well as the main linking cable to the rear case.
2. Remove the two securing screws and two washers that hold in the Control PCB and remove the PCB from the front case.
3. Reassemble in reverse order.

Important: When a new Control PCB is fitted the following procedure must be carried out.

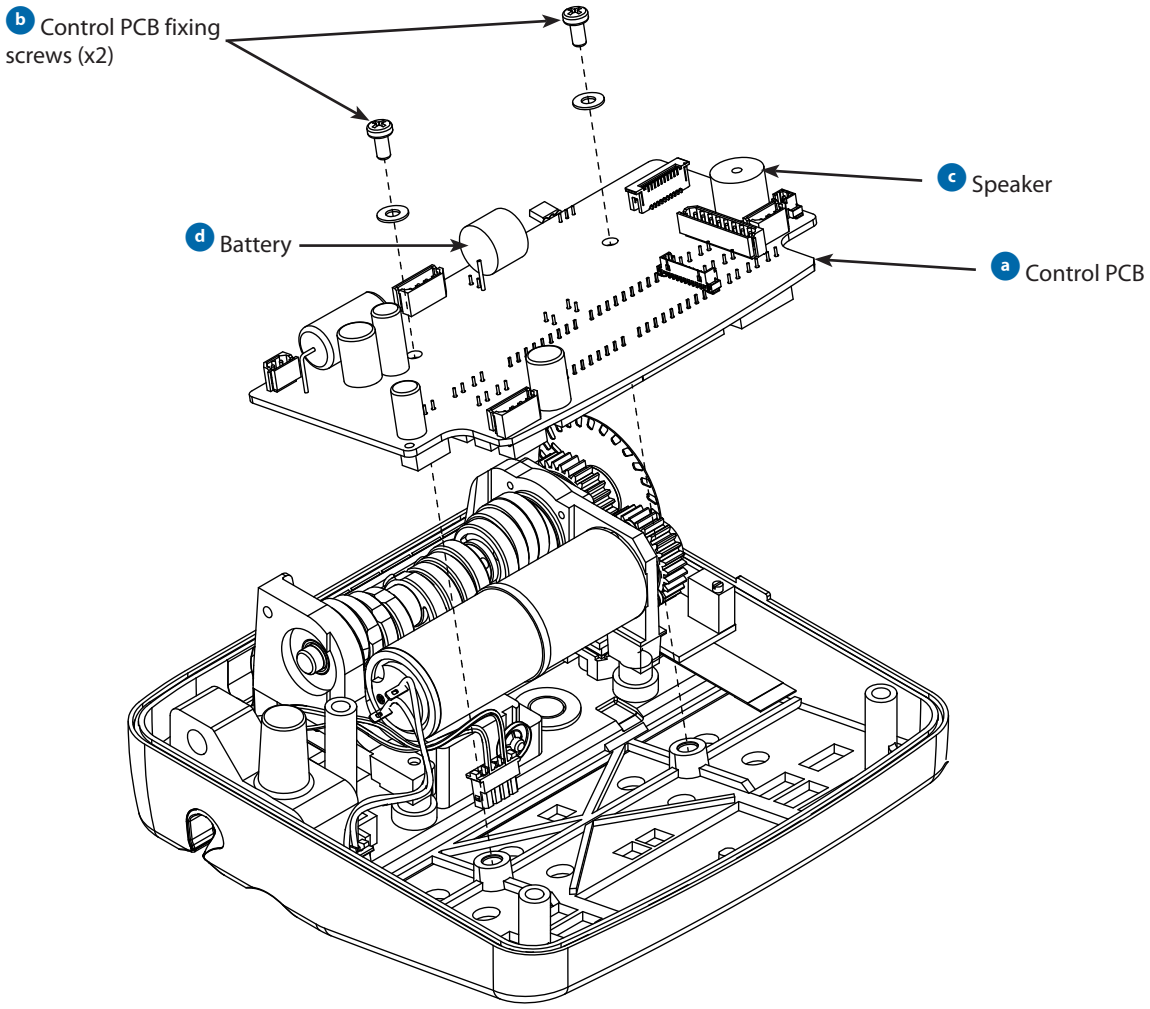
1. **Install the new Control PCB and reassemble the pump.**
2. **Power the pump up in normal user mode.**
3. **The pump will display tESt then after a short period of time will change to Err and alarm.**
4. **Power off pump.**
5. **Perform full calibration.**

Failure to perform this procedure in the correct order will result in Error code 35 being displayed constantly by the pump.

The removal and replacement of soldered components should only be undertaken by engineers trained to IPC standards.

The pump contains static sensitive components and therefore strict ESD precautions should be observed at all times.

Prior to removing any component it should be established if the PCB being reworked is a lead or lead free device. If in doubt, contact your CareFusion affiliate office or distributor for further information.



Item	Description	Part Number
a	ASENA GW, ASSY, CONTROL PCB	1000EL00347
b	ASENA GW, KIT, FIXINGS(SCREWS,WASHERS,ETC)	1000SP00489
c	Piezo Sounder	0000EL00986
d	Back Up Battery	0000EL00985

Rear case assembly

1. In order to replace a rear case, it will be necessary to fully strip down the old case and insert all of the components into the new rear case. The task requires a good knowledge of the product, so be certain that you are fully conversant with all of the procedures in this section before undertaking this replacement.
2. For each sub-assembly to be stripped down, follow the instructions in the relevant section of this manual. The recommended order for stripping down a rear case is described below :
   - Separate the front and rear case halves;
   - Remove the PSU and Comms. PCB;
   - Remove the pole clamp;
   - Remove battery.
3. The mains inlet assembly is very difficult to remove, so a new assembly is provided with the new rear case and the old one will have to be discarded with the old rear case.
4. When re-assembling these sub-assemblies into the new case, it is advisable to simply reverse the order of dis-assembly.
5. Having re-assembled all of the sub-assemblies described above, plug the mains inlet assembly into the PSU and Comms. PCB. Secure the earth cable onto the pumping block with the screw and shakeproof washer.

It is necessary to apply a new alarm code label and back panel label (with serial number and voltage information) at the end of assembly. These labels are language and pump specific.

Write the serial number and build issue of the pump on the two labels provided. Stick the larger one behind the window in the new back panel label and fix the second onto the back of the new case.

6. Finally re-assemble the pump.

Mains fuse replacement

- **Unplug the pump from all mains power and unscrew the fuse holders from the mains inlet. Replace the fuses as follows:**
  - **230V pump - 63mA anti-surge (T rated) fuses (0000EL00287)**
  - **115V pump - 125mA anti-surge (T rated) fuses (0000EL00288)**

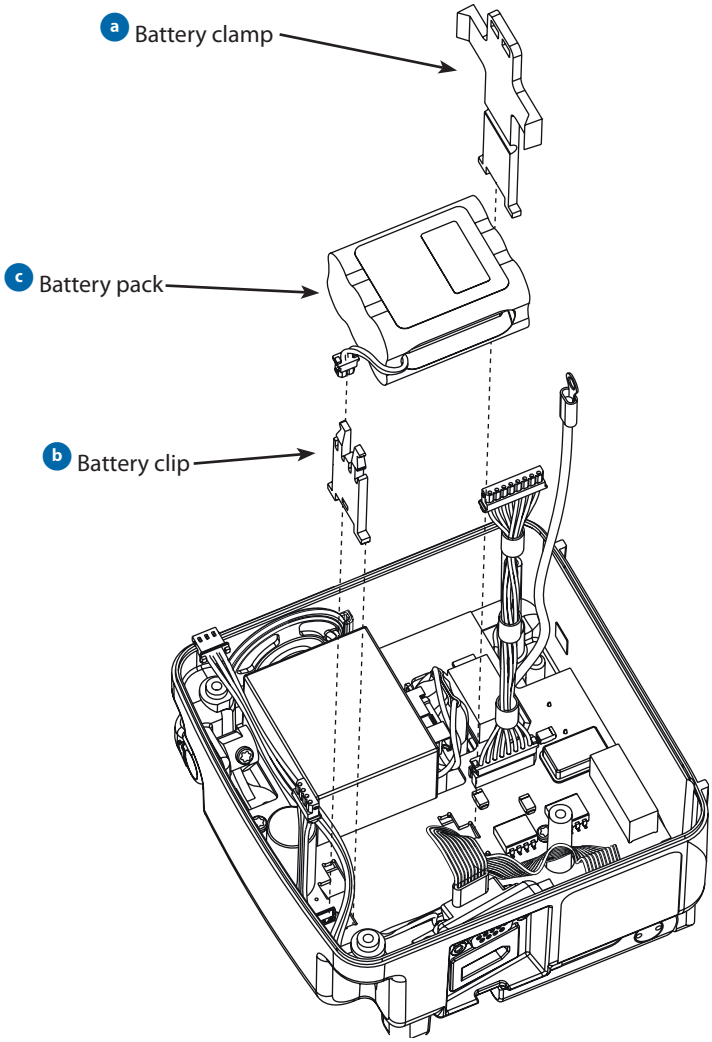
Battery fuse replacement

- **Unplug the mains inlet and battery from the Power Supply PCB and remove the PCB from the rear case. Unsolder the blown Pico fuse (F1) and replace with a new one of the following type:**
  - **1A Pico fuse (0000EL00809)**

Battery

It is recommended that the battery is replaced at least every 3 years, in order to guarantee maximum backup battery time.

1. Remove the small plastic clamp and clip that holds the battery in place. Unplug the battery from the PSU and Comms. PCB and remove the battery from the rear case.
2. Re-assemble in reverse order.

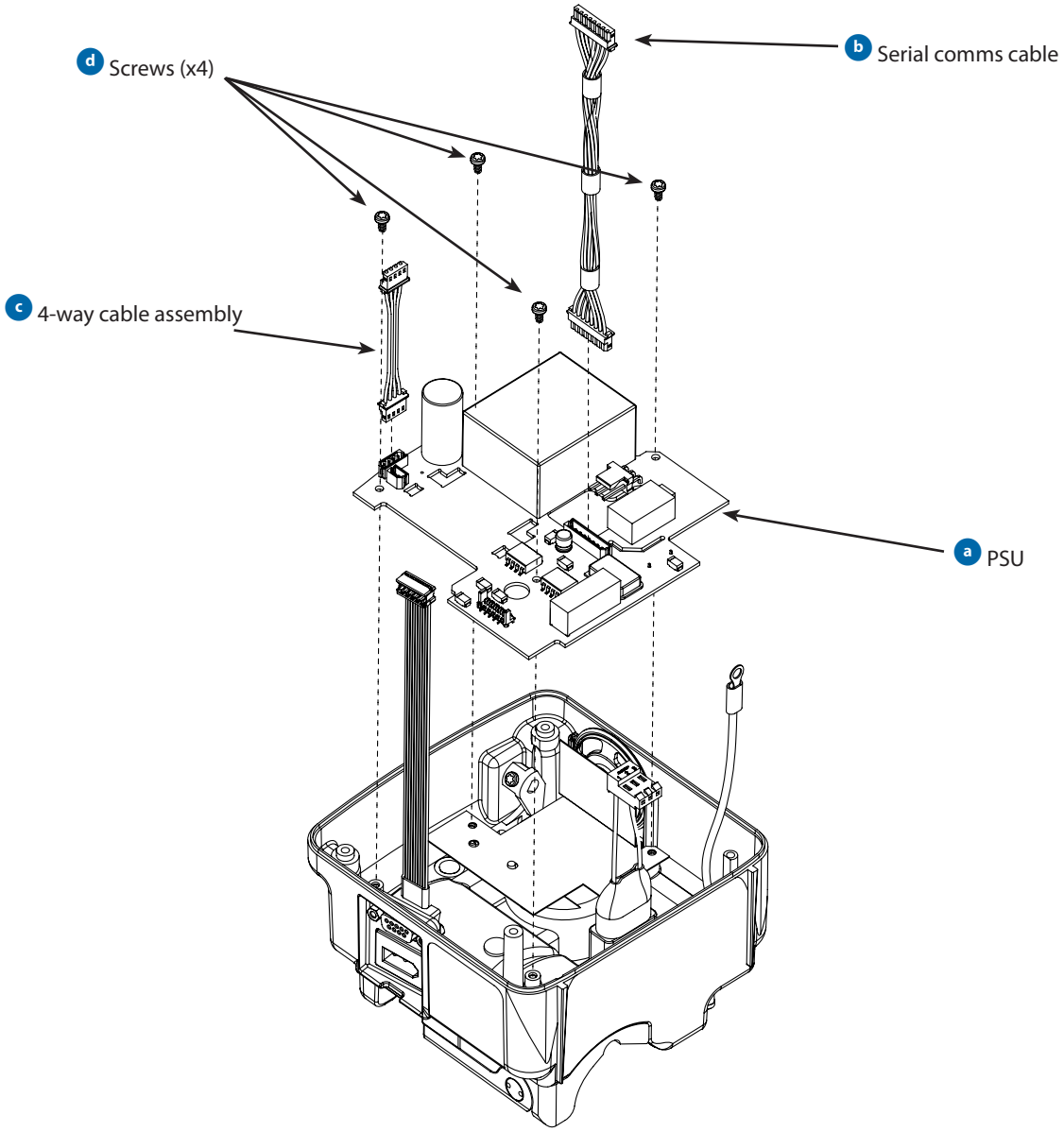


Any use of battery packs that are not manufactured by CareFusion in the Alaris® Volumetric Pump is at your sole risk, and CareFusion does not provide any warranty for or endorsement on any battery packs that are not manufactured by CareFusion. CareFusion's product warranty shall not apply in the event the Alaris® Volumetric Pump has suffered damage or premature wear, or malfunctions or otherwise operates incorrectly, as a result of use with a battery pack that is not manufactured by CareFusion.

Item	Description	Part Number
a	ASENA GW, ASSY, BATTERY CLAMP	1000ME00379
b	ASENA GW, ASSY, BATTERY CLIP	1000ME01481
c	BATTERY PACK NiMh FUSED ASENA GW	1000EL00349

PSU and Comms PCB

1. Unplug the mains inlet, the battery and the 4-way cable assembly from the PSU and Comms. PCB and 8-way connector and flow sensor connector.
2. Remove the four securing screws that hold in the PCB and remove the PCB from the rear case.
3. Reassemble in reverse order.



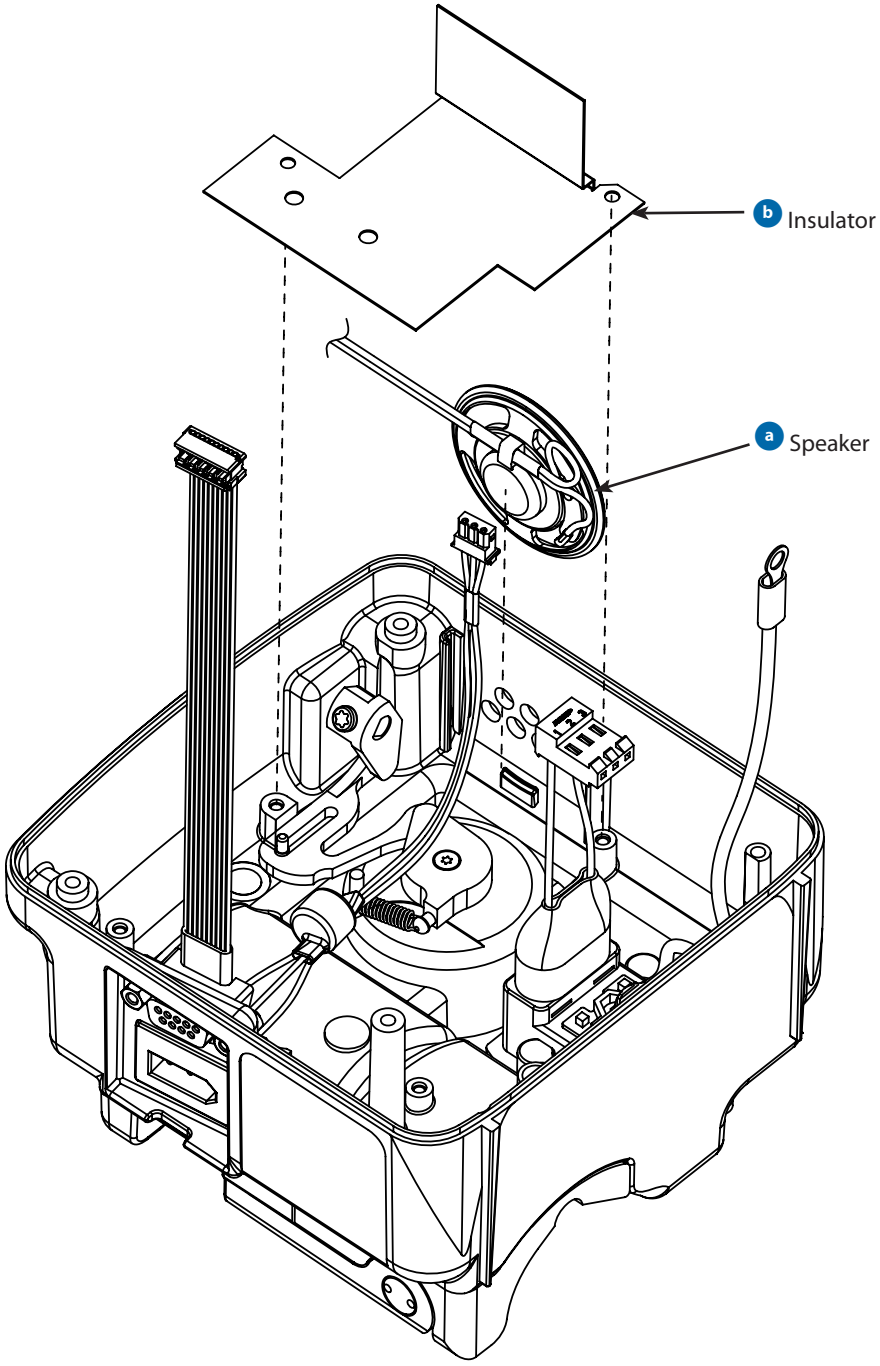
Flow sensor and speaker cables have been removed for clarity.

Power supply kit (1000SP00427) includes new RS232 connector and battery clamp, as previous parts are not compatible with new PSU. Replace RS232 connector and battery clamp if required.

Item	Description	Part Number
a	ASENA GW, KIT, POWER SUPPLY UNIT (PSU)	1000SP00427
b	ASENA GW, ASSY, SERIAL COMMS CABLE	1000SP01135
c	ASSY CABLE 4 WAY	1000SP01076
d	ASENA GW, KIT, FIXINGS(SCREWS,WASHERS,ETC)	1000SP00489

Speaker

1. Remove or replace insulator or speaker as required.



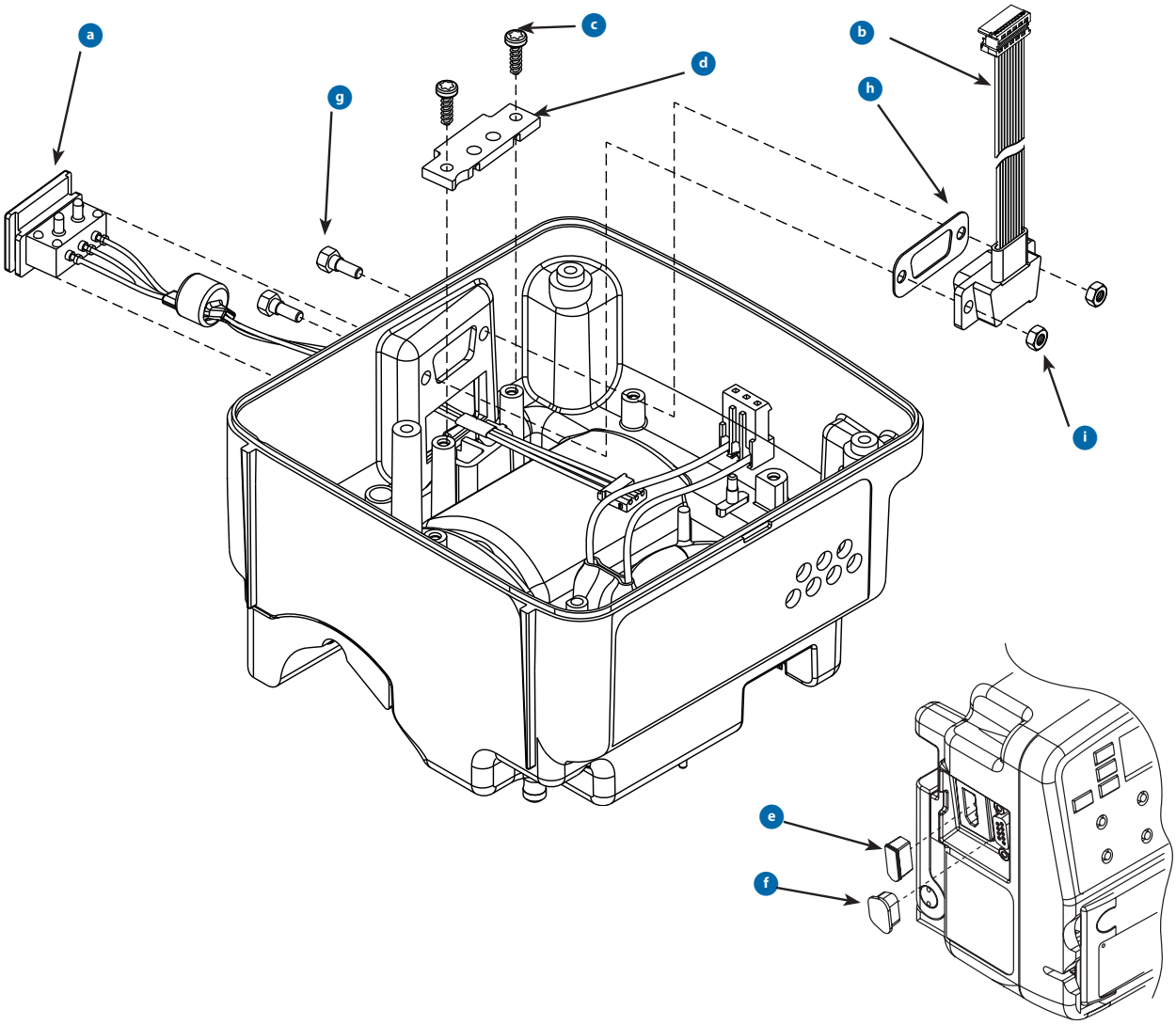
Item	Description	Part Number
a	ASSY SPEAKER ALARM P8000	1000SP00099
b	INSULATOR ASENA GW	1000ME01429

Rear case connectors

1. Remove RS232 connector.
2. Remove screws holding Flow Sensor Clamp and remove clamp.
3. Remove Flow Sensor connector.
4. Reassemble in reverse order.

In order to reduce the likelihood of nuisance FLo Err alarms occurring a flow sensor marked with V2.0 on the connector should be used.

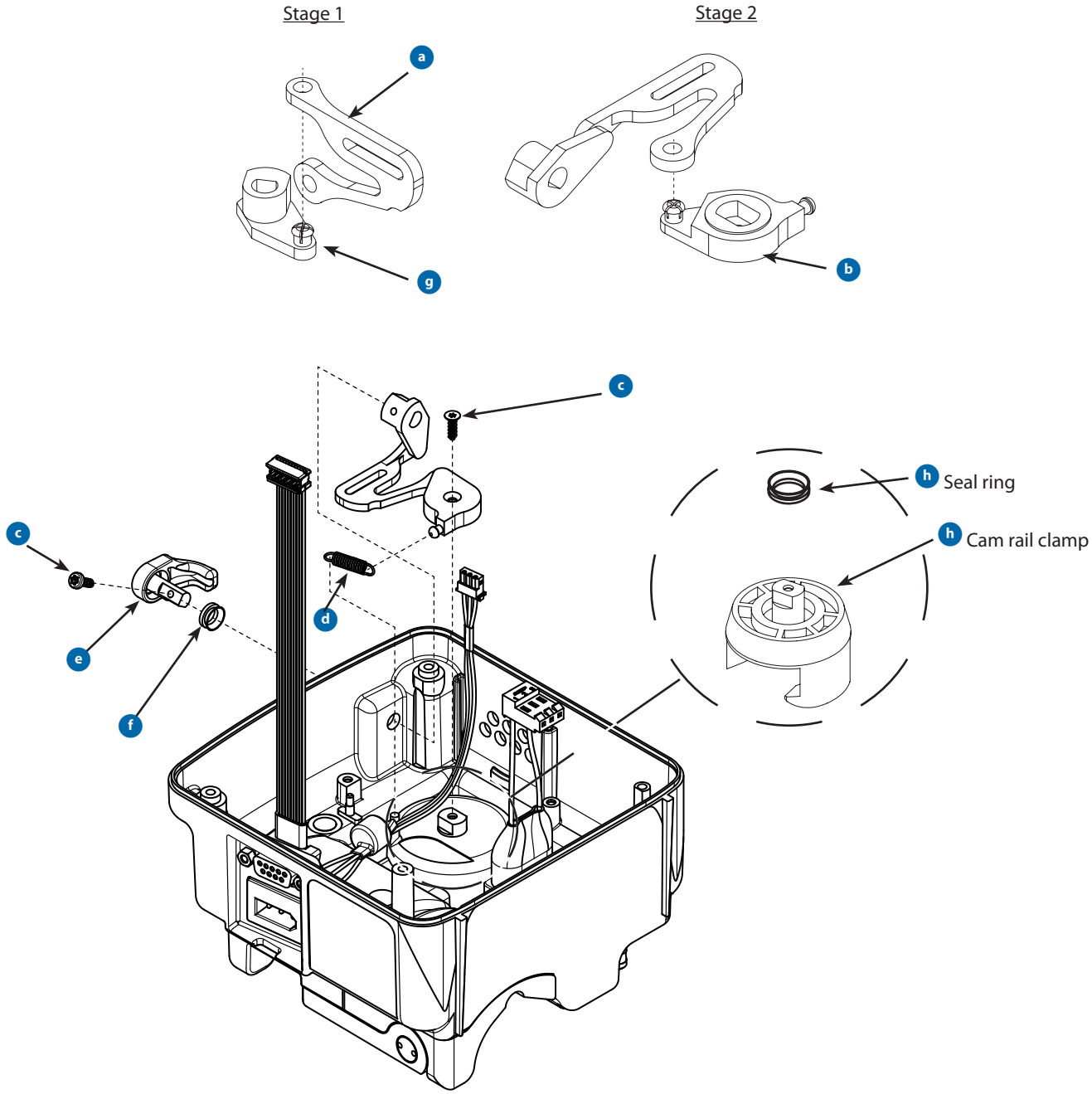
If nuisance alarms continue to occur replace drop sensor cable (1000SP01431).



Item	Description	Part Number
a	GW DROP SENSOR CABLE ASSY - SPARE PART	1000SP01431
b	ASENA ASSY, KIT, RS232 CABLE	1000SP00336
c	ASENA GW, KIT, FIXINGS(SCREWS,WASHERS,ETC)	1000SP00489
d	ASENA GW, ASSY, DROP SENSOR CLAMP	1000ME01402
e	ASENA GW, ASSY, COVER DUST DROP SENSOR	1000ME00291
f	ASENA GW, ASSY, COVER DUST RS232	0000ME00444
g	STUD SHOULDER M3 RS232	1000ME01362
h	GASKET RS232 P8000	1000ME01300
i	ASENA GW, KIT, FIXINGS(SCREWS,WASHERS,ETC)	1000SP00489

Rear Case Rail Cam Mechanism

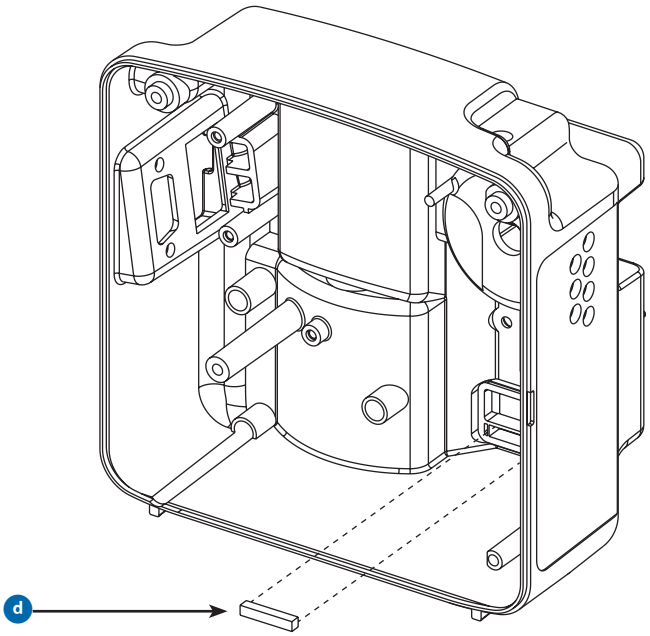
1. Assemble rail cam internal mechanism as per diagrams below.
2. Remove and replace cam rail components as required.
3. Reassemble in reverse order.



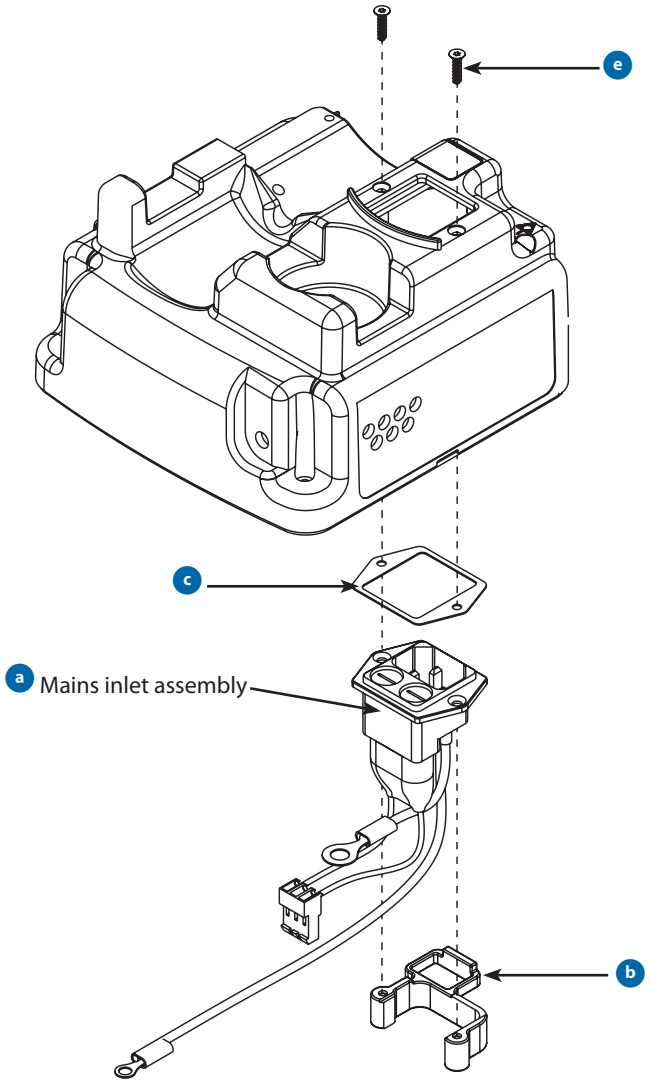
Item	Description	Part Number
a	LINKING ASENA GW	1000ME01401
b	LEVER RAIL CAM INTERNAL	1000ME01205
c	ASENA GW, KIT, FIXINGS(SCREWS,WASHERS,ETC)	1000SP00489
d	SPRING RAIL CAM P8000	0000ME00419
e	LEVER RELEASE RAIL CLAMP	1000ME01203
f	SEAL RING V 6MM DIA	0000ME00381
g	LEVER PUMP RELEASE MACHINED	1000SP00241
h	ALARIS SP CAM RAIL CLAMP ONLY KIT	1000SP01323

Mains inlet

1. Remove 2 screws securing Mains inlet and retainer.
2. Remove Mains inlet and retainer.
3. Remove magnet.
4. Reassemble in reverse order.



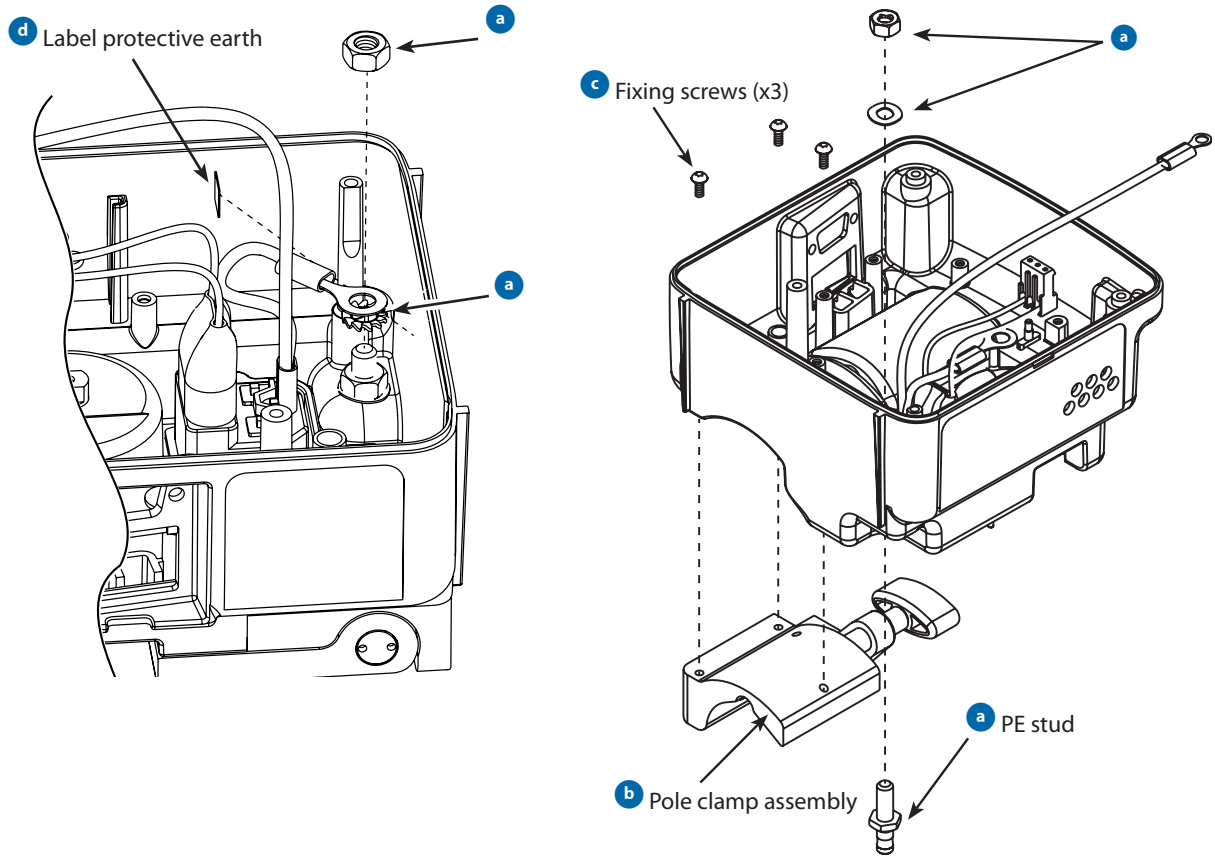
Magnet (item d) can be held in place with a plastic covered proximity magnet placed over IR window. Magnet will be held in place with mains inlet retainer (item b).



Item	Description	Part Number
a	ASENA GW, ASSY, MAINS INLET	1000SP01134
b	ASENA GW, ASSY, MAINS INLET RETAINER	1000ME01443
c	GASKET MAINS INLET	1000ME01299
d	MAGNET IR DETECT	1000ME01303
e	ASENA GW, KIT, FIXINGS(SCREWS,WASHERS,ETC)	1000SP00489

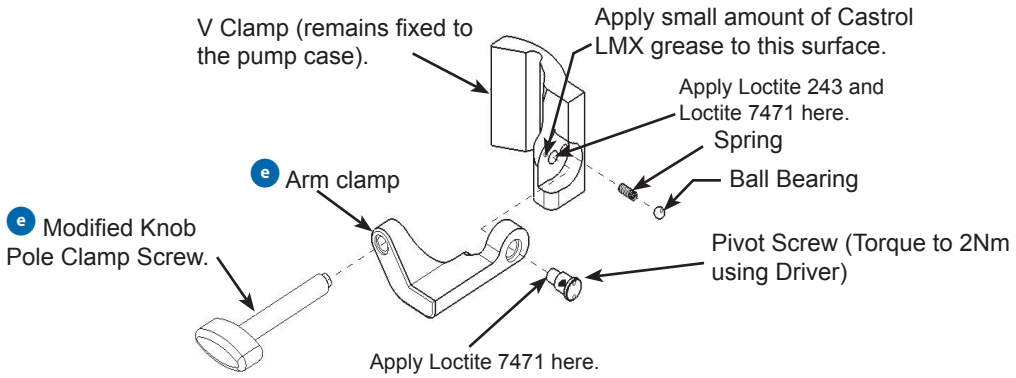
PE Stud and Pole Clamp

1. Remove nut securing earth wire.
2. Remove nut securing PE Stud.
3. Remove the three screws and remove the pole clamp assembly.
4. Reassemble in reverse order.



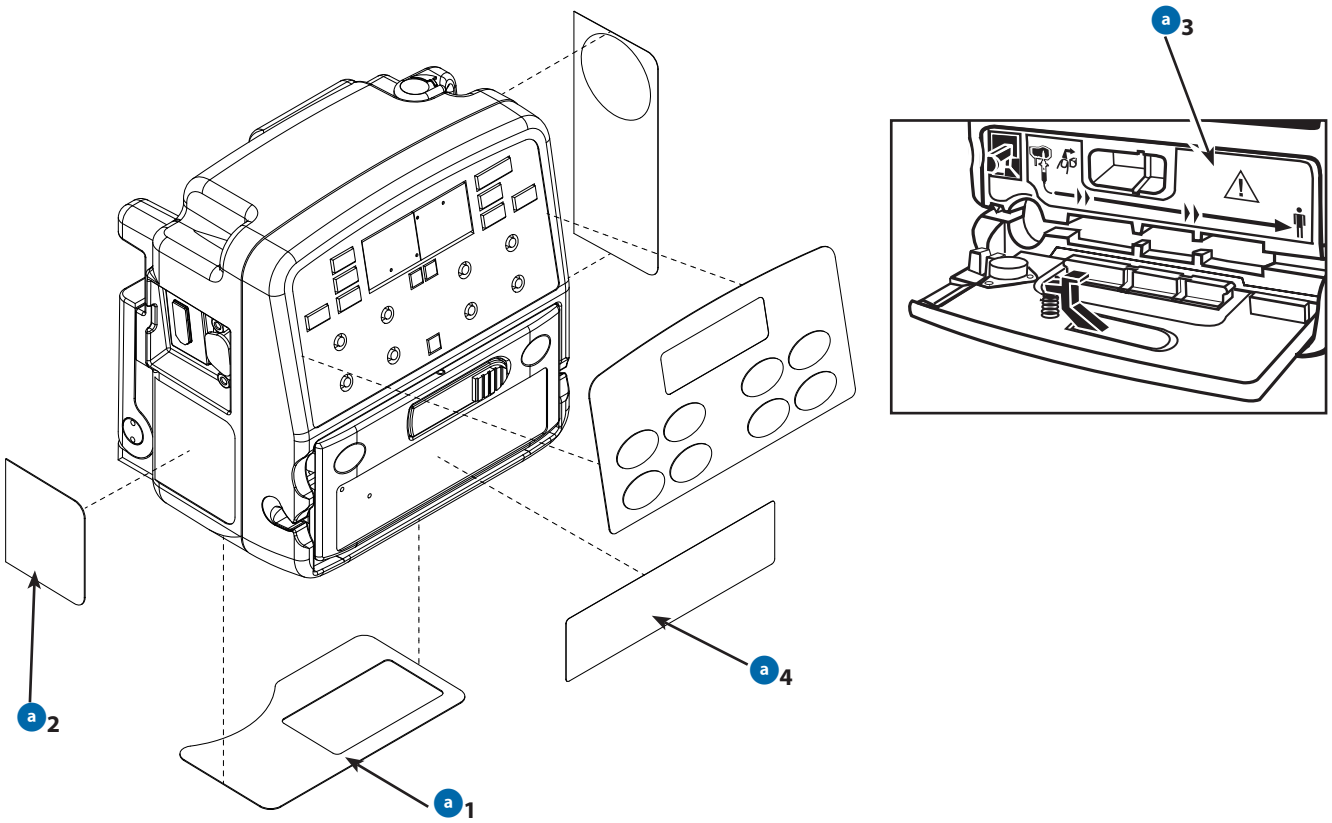
The Pole Clamp Arm material has been changed to a stronger material to prevent the arm from bending when tightened.

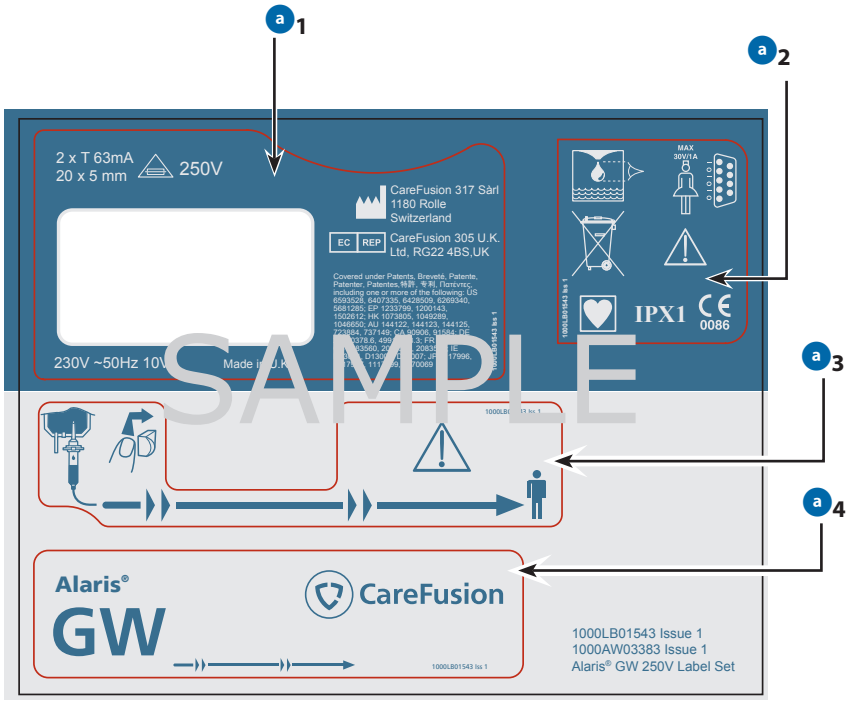
The Pole Clamp Arm spares kit replaces parts of the Pole Clamp assembly to address bent or slipping Pole Clamps. Note: There is no requirement to remove the V Clamp.



Item	Description	Part Number
a	ASENA SP, KIT, PE STUD	1000SP00467
b	ASENA SP, ASSY, POLE CLAMP	1000SP00115
c	ASENA GW, KIT, FIXINGS(SCREWS,WASHERS,ETC)	1000SP00489
d	LABEL PROTECTIVE EARTH	1000LB00292
e	SPARES KIT POLE CLAMP ARM	1000SP00589
f	POLE CLAMP SNAKE EYE DRIVER (not shown)	1000ME01466

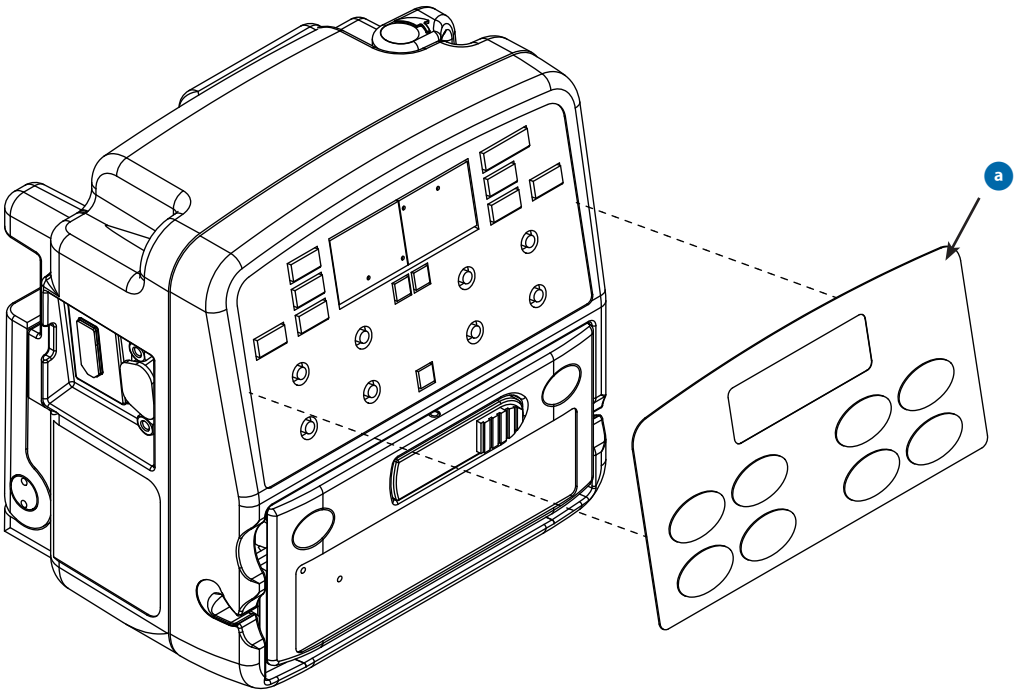
Labels



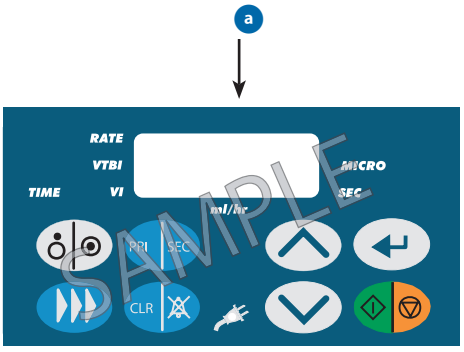


Item	Description	Part Number
a	ASENA GW 250V LABEL SET	1000LB01543
a	ASENA GW 110V LABEL SET	1000LB01542
b	LABEL PROTECTIVE EARTH (x2)	1000LB00292

Item b not shown - located on pumping block and inside rear case.

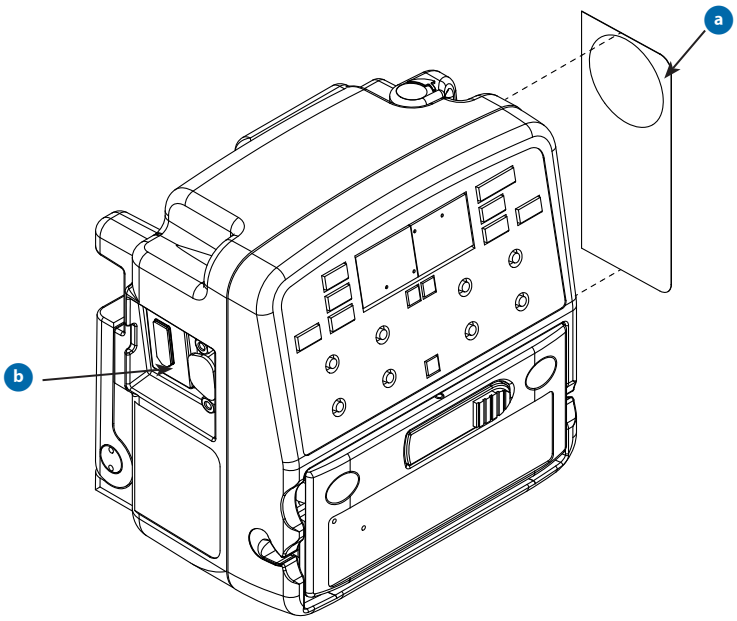


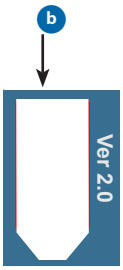
Note: After fitting label, verify all LEDs are fully visible at their correct locations.



English language sample shown. See parts list below for language specific options.

Item	Description	Part Number
a	ASENA GW, LBL, FRONT PANEL ENGLISH	1000LB00251
	ASENA GW, LBL, FRONT PANEL FRENCH	1000LB00287
	ASENA GW, LBL, FRONT PANEL ITALIAN	1000LB00288
	ASENA GW, LBL, FRONT PANEL GERMAN	1000LB00290
	ASENA GW, LBL, FRONT PANEL SPANISH	1000LB00291
	ASENA GW, LBL, FRONT PANEL DUTCH	1000LB00389
	ASENA GW, LBL, FRONT PANEL SWEDISH	1000LB00393





Label (b) required to be fitted to an Inline Resistor Drop Sensor Cable Assy only.

English language sample shown.

See parts list below for language specific options.

Item	Description	Part Number	Item	Description	Part Number
a	ASENA GW, LBL, ALARM ENGLISH	1000LB00374	a	ALARIS GW ALARM LABEL RUSSIAN	1000LB01473
a	ASENA GW, LBL, ALARM GERMAN	1000LB00386	a	ALARIS GW ALARM LABEL ROMANIAN	1000LB01474
a	ASENA GW, LBL, ALARM FRENCH	1000LB00396	a	ALARIS GW ALARM LABEL SLOVENIAN	1000LB01480
a	ASENA GW, LBL, ALARM ITALIAN	1000LB00397	a	ALARIS GW ALARM LABEL DANISH	1000LB01489
a	ASENA GW, LBL, ALARM SPANISH	1000LB00398	a	ALARIS GW ALARM LABEL Greek	1000LB01524
a	ASENA GW, LBL, ALARM SWEDISH	1000LB00399	a	ALARIS GW ALARM LABEL Finnish	1000LB01525
a	ASENA GW, LBL, ALARM DUTCH	1000LB00400	a	ALARIS GW ALARM LABEL Macedonian	1000LB01591
a	ASENA GW, LBL, ALARM PORTUGUESE	1000LB00420	a	ALARIS GW ALARM LABEL Norwegian	1000LB00411
a	ALARIS GW ALARM LABEL POLISH	1000LB01470	a	ALARIS GW ALARM LABEL Serbian	1000LB01523
a	ALARIS GW ALARM LABEL HUNGARIAN	1000LB01471	a	ALARIS GW ALARM LABEL Turkish	1000LB01490
a	ALARIS GW ALARM LABEL CZECH	1000LB01472	a	ALARIS GW ALARM LABEL Croatian	1000LB01598
a	ALARIS GW ALARM LABEL ESTONIA	1000LB01478			
a	ALARIS GW ALARM LABEL LATVIA	1000LB01479	b	DROP SENSOR CONNECTOR LABEL	1000LB01466

7 Appendix

Electromagnetic Compatibility

Warning:

- The use of any accessory, transducer, or cable with the Alaris® GW Volumetric Pump other than those specified may result in increased emissions or decreased immunity of the pump.
- The Alaris® GW Volumetric Pump should not be used adjacent to or stacked with other equipment and that is adjacent or stacked use is necessary, the Alaris® GW Volumetric Pump should be observed to verify normal operation in the configuration in which it will be used.

Caution:

- The Alaris® GW Volumetric Pump is a CISPR 11 Group 1 Class A Medical Equipment System and intended for use by healthcare professionals only.
- Medical Electrical Equipment needs special precautions regarding EMC and needs to be installed, put into service and used according to the EMC information provided in the accompanying documents.
- Portable and Mobile RF communications can affect Medical Electrical Equipment.
- Operating the pump near equipment which radiates high energy radio frequencies (electro surgical or cauterizing equipment, portable radios, cellular telephones, etc.) may cause false alarm conditions. If this happens, reposition the pump away from the source of interference or turn off the pump and manually regulate the flow.

Guidance and Manufacturer's Declaration – Electromagnetic Emissions

The Alaris® GW Volumetric Pump is intended for use in the electromagnetic environment specified below.

The customer or the user of the Alaris® GW Volumetric Pump should assure that it is used in such an environment.

Emissions Test	Compliance	Electromagnetic Environment – Guidance
CISPR 11 RF Emissions	Group 1	The pump uses RF energy only for its internal function in the normal product offering. Therefore, its RF emissions are very low and are not likely to cause any interface in nearby electronic equipment.
CISPR 11 RF Emissions	Class A	The pump is suitable for use in all establishments, other than domestic, and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
EN 61000-3-2 Harmonic Emissions	Class A	
EN 61000-3-3 Voltage Fluctuations, Flicker Emissions	Complies	

Guidance and Manufacturer's Declaration - Electromagnetic Immunity

The Alaris® GW Volumetric Pump is intended for use in the electromagnetic environment specified below.
The customer or the user of the Alaris® GW Volumetric Pump should assure that it is used in such an environment.

Immunity Test	EN 60601-1-2 Test Level	Compliance Level	Electromagnetic Environment – Guidance
EN 61000-4-2 Electro-Static Discharge (ESD)	±6 kV contact ±8 kV air	±8 kV contact (Note 2) ±15 kV air (Note 2)	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %. If connector testing exemption is used, the following symbol for ESD sensitivity appears adjacent to each connector. "Caution – Do Not Touch". 
EN 61000-4-4 Electrical Fast Transient, Burst (EFT) (Note 3)	±2 kV for power supply lines ±1 kV for input/ output lines	±2 kV for power supply lines N/A (Note 4)	Mains power quality should be that of a typical commercial or hospital environment.
EN 61000-4-5 Power Line Surge (Note 3)	±1 kV Line(s) to Line(s) ±2 kV Line(s) to Earth	±1 kV Line(s) to Line(s) ±2 kV Line(s) to Earth	Mains power quality should be that of a typical commercial or hospital environment.
EN 61000-4-8 Power Frequency Magnetic Field (50/60 Hz)	3 A/m	400 A/m 50 Hz (Note 2)	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
EN 61000-4-11 Voltage Dips, Short Interruptions, and Voltage Variations (Note 3)	<5 % U_T (Note 1) (>95 % dip in U_T) for 0.5 cycle	<5 % U_T (>95 % dip in U_T) for 0.5 cycle	Mains power quality should be that of a typical commercial or hospital environment. If the user of the pump requires continued operation during power mains interruptions, it is recommended that the pump be powered from an uninterruptible power supply or a battery. The pump does employ an internal short duration battery.
	40 % U_T (60 % dip in U_T) for 5 cycles	40 % U_T (60 % dip in U_T) for 5 cycles	
	70 % U_T (30 % dip in U_T) for 25 cycles	70 % U_T (30 % dip in U_T) for 25 cycles	
	<5 % U_T (>95 % dip in U_T) for 5 sec	<5 % U_T (>95 % dip in U_T) for 5 sec	

Note 1—U_T is the AC mains voltage prior to application of the test level.

Note 2—Compliance levels raised by EN 60601-2-24.

Note 3—Performed at the Minimum and Maximum Rated Input Voltage.

Note 4—CareFusion recommends using signal cables of less than 3 metres in length and this requirement is applicable only if signal cables are 3 metres or more in length. (EN 60601-1-2:2002, Clause 36.202.4)

Guidance and Manufacturer's Declaration—Electromagnetic Immunity

LIFE SUPPORT Equipment

The Alaris® GW Volumetric Pump is intended for use in the electromagnetic environment specified below.
The customer or the user of the Alaris® GW Volumetric Pump should ensure that it is used in such an environment.

Immunity Test	EN 60601-1-2 Test Level	Compliance Level	Electromagnetic Environment – Guidance
EN 61000-4-6 Conducted RF	3 V rms 150 kHz to 80 MHz	10 V rms (Note 3)	Portable and mobile RF communications equipment should be used no closer to any part of the pump, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended Separation Distance $d = \left[\frac{3.5}{V1}\right]\sqrt{P}$
EN 61000-4-3 Radiated RF	3 V/m 80 MHz to 2.5 GHz	10 V/m (Note 3)	$d = \left[\frac{12}{V2}\right]\sqrt{P}$ 80 MHz to 800 MHz $d = \left[\frac{12}{E1}\right]\sqrt{P}$ 80 MHz to 2.5 GHz $d = \left[\frac{23}{E1}\right]\sqrt{P}$ 800 MHz to 2.5 GHz where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in metres (m).[a] Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, [b] should be less than the compliance level in each frequency range. [c] Interference may occur in the vicinity of equipment marked with the following symbol: 

Note 1—At 80 MHz and 800 MHz, the higher frequency range applies.

Note 2—These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

Note 3—Compliance levels raised by EN 60601-2-24.

[a] The compliance levels in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2.5 GHz are intended to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas. For this reason, an additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in these frequency ranges.

[b] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the pump is used exceeds the applicable RF compliance level above, the pump should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the pump.

[c] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 10 V/m.

Recommended Separation Distances for LIFE SUPPORT Equipment between portable and mobile RF communications equipment and the Alaris® GW Volumetric Pump

The Alaris® GW Volumetric Pump is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled.

The user of the Alaris® GW Volumetric Pump can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Alaris® GW Volumetric Pump as recommended below, according to the maximum output power of the communications equipment.

Rated Maximum Output Power of Transmitter W	Separation Distance According to Frequency of Transmitter m			
	150 kHz to 80 MHz Outside ISM bands 3.5 $d = [\text{------}] \sqrt{P}$ V1	150 kHz to 80 MHz In ISM bands 12 $d = [\text{------}] \sqrt{P}$ V2	80 MHz to 800 MHz 12 $d = [\text{------}] \sqrt{P}$ E1	800 MHz to 2.5 GHz 23 $d = [\text{------}] \sqrt{P}$ E1
0.01	0.03	0.12	0.12	0.23
0.1	0.11	0.38	0.38	0.73
1	0.35	1.20	1.20	2.30
10	1.11	3.80	3.80	7.28
100	3.50	12.00	12.00	23.00

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in metres (m) can be determined using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

Note 1—At 80 MHz and 800 MHz, the separation distance for the higher frequency range apply.

Note 2—The ISM (Industrial, Scientific, and Medical) bands between 150 kHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz.

Note 3—An additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2.5 GHz to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas.

Note 4—These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

Disposal

Information on Disposal for Users of Waste Electrical and Electronic Equipment

This ⌧ symbol on the product and/or accompanying documents means that used electrical and electronic products should not be mixed with municipal waste.

If you wish to discard electrical and electronic equipment, please contact your CareFusion affiliate office or distributor for further information.

Disposing of this product correctly will help to save valuable resources and prevent any potential negative effects on human health and the environment which could otherwise arise from inappropriate waste handling.

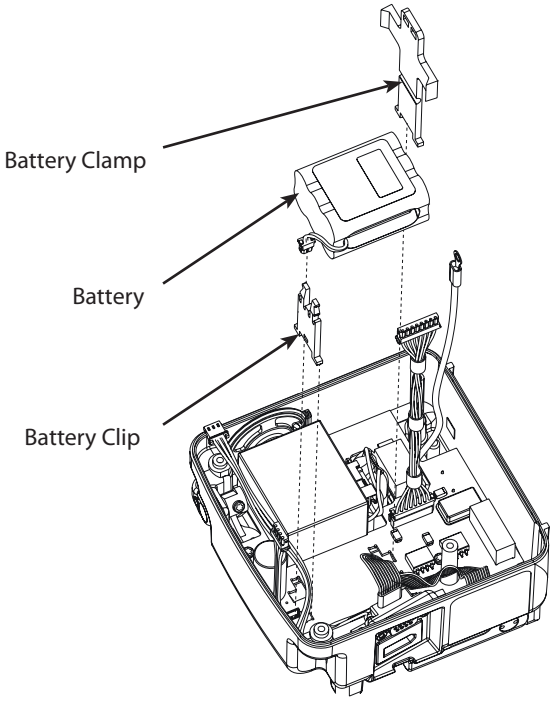
Information on Disposal in Countries outside the European Union

This symbol is only valid in the European Union. The product should be disposed of taking environmental factors into consideration. To ensure no risk or hazard, remove the internal rechargeable battery and the Nickel Metal Hydride battery from the control board and dispose of as outlined by the local country regulations. All other components can be safely disposed of as per local regulations.

Battery Removal

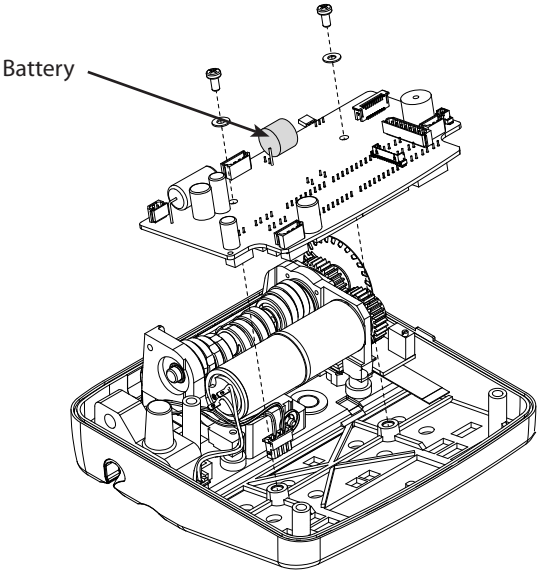
Remove the Main Battery

1. Remove the small plastic clamp and clip that holds the battery in place.
2. Unplug the battery from the PSU and Comms. PCB and remove the battery from the rear case.



Remove the Battery on Control PCB

1. Remove the Control PCB from the pump, see 'Spare Parts Replacement Procedures'.
2. Remove battery from the Control PCB.



Spare Parts Listing

Labels and Publications

Part Number	Description
1000LB00386	ASENA GW, LBL, ALARM GERMAN
1000LB00398	ASENA GW, LBL, ALARM SPANISH
1000LB00396	ASENA GW, LBL, ALARM FRENCH
1000LB00374	ASENA GW, LBL, ALARM ENGLISH
1000LB00397	ASENA GW, LBL, ALARM ITALIAN
1000LB00400	ASENA GW, LBL, ALARM DUTCH
1000LB00399	ASENA GW, LBL, ALARM SWEDISH
1000LB00420	ASENA GW, LBL, ALARM PORTUGUESE
1000LB01470	ALARIS GW ALARM LABEL POLISH
1000LB01471	ALARIS GW ALARM LABEL HUNGARIAN
1000LB01472	ALARIS GW ALARM LABEL CZECH
1000LB01473	ALARIS GW ALARM LABEL RUSSIAN
1000LB01474	ALARIS GW ALARM LABEL ROMANIAN
1000LB01478	ALARIS GW ALARM LABEL ESTONIA
1000LB01479	ALARIS GW ALARM LABEL LATVIA
1000LB01480	ALARIS GW ALARM LABEL SLOVENIAN
1000LB01489	ALARIS GW ALARM LABEL DANISH
1000LB01524	ALARIS GW ALARM LABEL Greek
1000LB01525	ALARIS GW ALARM LABEL Finnish
1000LB01591	ALARIS GW ALARM LABEL Macedonian
1000LB00411	ALARIS GW ALARM LABEL Norwegian
1000LB01523	ALARIS GW ALARM LABEL Serbian
1000LB01490	ALARIS GW ALARM LABEL Turkish
1000LB00389	ASENA GW, LBL, FRONT PANEL DUTCH
1000LB00393	ASENA GW, LBL, FRONT PANEL SWEDISH
1000LB00251	ASENA GW, LBL, FRONT PANEL ENGLISH
1000LB00287	ASENA GW, LBL, FRONT PANEL FRENCH
1000LB00290	ASENA GW, LBL, FRONT PANEL GERMAN
1000LB00288	ASENA GW, LBL, FRONT PANEL ITALIAN
1000LB00291	ASENA GW, LBL, FRONT PANEL SPANISH
1000LB00292	LABEL PROTECTIVE EARTH
1000LB01542	ASENA GW 110V LABEL SET
1000LB01543	ASENA GW 250V LABEL SET
1000LB01466	DROP SENSOR CONNECTOR LABEL

Rear case components

Part Number	*Description*
1000SP00339	ASENA GW, KIT, REAR CASE 230V GERMAN
1000SP00324	ASENA GW, KIT, REAR CASE 230V SPANISH
1000SP00322	ASENA GW, KIT, REAR CASE 230V FRENCH
1000SP00261	ASENA GW, KIT, REAR CASE 230V ENGLISH
1000SP00326	ASENA GW, KIT, REAR CASE 110V ENGLISH
1000SP00323	ASENA GW, KIT, REAR CASE 230V ITALIAN
1000SP00340	ASENA GW, KIT, REAR CASE 230V DUTCH
1000SP00368	ASENA GW, KIT, REAR CASE 230V NORWEGIAN
1000SP00325	ASENA GW, KIT, REAR CASE 230V SWEDISH
1000SP00467	ASENA SP/GW, KIT, PE STUD
1000SP00336	ASENA ASSY, RS232 CABLE
0000ME00444	ASENA GW, ASSY, COVER DUST RS232
1000ME01401	LINKING ASENA GW
1000ME01205	LEVER RAIL CAM INTERNAL
0000ME00419	SPRING RAIL CAM P8000
1000ME01203	LEVER RELEASE RAIL CLAMP
0000ME00381	SEAL RING V 6MM DIA
1000SP00241	LEVER PUMP RELEASE MACHINED
1000SP01323	ALARIS SP CAM RAIL CLAMP ONLY KIT
1000ME00291	ASENA GW, ASSY, COVER DUST DROP SENSOR
1000ME01299	GASKET MAINS INLET
1000ME01303	MAGNET IR DETECT
1000ME01402	ASENA GW, ASSY, DROP SENSOR CLAMP
1000ME01429	ASENA GW, ASSY, REAR CASE INSULATOR
1000ME01443	ASENA GW, ASSY, MAINS INLET RETAINER
1000ME01481	ASENA GW, ASSY, BATTERY CLIP
1000SP00115	ASENA SP, ASSY, POLE CLAMP
1000ME00379	ASENA GW, ASSY, BATTERY CLAMP
1000ME01362	STUD SHOULDER M3 RS232
1000ME01300	GASKET RS232 P8000
1000SP00489	ASENA GW, KIT, FIXINGS (SCREWS,WASHERS,ETC)
1000SP00589	SPARES KIT POLE CLAMP ARM

Mechanical components

Part Number	*Description*
1000SP00257	ASENA GW, KIT, PUMP BLOCK 230V
1000SP00329	ASENA GW, KIT, PUMP BLOCK 110V
0000EL00816	ASENA GW, ASSY, STRIP FINGER (Be Cu)
1000SP01569	GW Pumping Finger Kit

Front case components

Part Number	*Description*
1000SP00343	ASENA GW, KIT, FRONT CASE 230V GERMAN
1000SP00333	ASENA GW, KIT, FRONT CASE 230V SPANISH
1000SP00331	ASENA GW, KIT, FRONT CASE 230V FRENCH
1000SP00252	ASENA GW, KIT, FRONT CASE 230V ENGLISH
1000SP00327	ASENA GW, KIT, FRONT CASE 110V ENGLISH
1000SP00332	ASENA GW, KIT, FRONT CASE 230V ITALIAN
1000SP00344	ASENA GW, KIT, FRONT CASE 230V DUTCH
1000SP00334	ASENA GW, KIT, FRONT CASE 230V SWEDISH/NORWEGIAN
1000SP00254	ASENA GW, KIT, FLOWSTOP MECHANISM 230V
1000SP00328	ASENA GW, KIT, FLOWSTOP MECHANISM 110V
1000SP00253	ASENA GW, KIT, DOOR
1000ME02053	ASENA GW, ASSY, BACKSTOP/MEMBRANE CLAMP
1000ME01151	MAGNET DOOR
1000SP01358	ALARIS GW DOOR SPARES KIT
1000ME00289	Locator Tubing Asena GW
1000SP01652	GW SEALING CORD KIT

Electrical components

Part Number	*Description*
1000SP00427	ASENA GW, KIT, POWER SUPPLY UNIT (PSU)
1000SP00330	ASENA GW, KIT, PRESSURE SENSOR 110V
1000SP00265	ASENA GW, KIT, AIR SENSORS
1000SP00256	ASENA GW, KIT, PRESSURE SENSOR 230V
1000SP00099	ASSY SPEAKER ALARM P8000
1000SP01076	ASSY CABLE 4 WAY
1000SP01431	GW DROP SENSOR CABLE ASSY - SPARE PART
1000SP01134	ASENA GW, ASSY, MAINS INLET
1000SP01135	ASENA GW, ASSY, SERIAL COMMS CABLE
0000EL00288	FUSE 125mA 20mm A/S ANTI-SURGE
1000EL00347	ASENA GW, ASSY, CONTROL PCB
1000EL00349	BATTERY PACK NIMH FUSED ASENA GW
0000EL00287	FUSE 63mA 20mm A/S ANTI-SURGE
0000EL00809	FUSE PICO 1A ANTISURGE
0000EL00986	Piezo Sounder
0000EL00985	Back Up Battery

Test Equipment

Part Number	*Description*
1000ME01466	POLE CLAMP SNAKE EYE DRIVER
0000TG00074	TEST GEAR TUBING ASENA TESTING
1000SP00493	ASENA GW, SOFT, SOFTWARE CD V5R1
1000SP00172	ASENA SP, KIT, IRDA PORT CABLE and HEADER PCB
1000SP00336	ALARIS SP/GW, ASSY, R232 CABLE

Fitting and Replacement Guidelines

General assembly information

A wide range of self-tapping fasteners are available.

PT screws are for plastic, self-tapping applications.

Almost all fasteners on the Alaris® GW Volumetric Pump are self tapping and have the potential to be over tightened (over torqued).

The force required to create a thread for the first time is more than when reassembling a previously made joint.

Always use the correct torque level when first making an assembly stage.

Take care with the torque applied when re-assembling parts. Less torque is required, so a hand tool may be more appropriate.

In many situations a stripped thread will require replacement of the failed component.

The head patterns of the fasteners are of the following types:

- Pozi Number 1 (smaller X head)
- Pozi Number 2 (larger X head)
- Torx Number T8 (Small star profile, used typically on countersunk parts with smaller heads).
- Torx Number T10 (Medium star profile)
- M6 nut

Always select the correct tool and bit pattern for the fastener.

Torque guide

The following list outlines the torque levels established during pump manufacture.

Torque levels selected apply throughout product life for the Alaris® GW Volumetric Pump.

Use this information as a guide to the 'do not exceed' torque levels when servicing the pump. When servicing it is recommended that torque is applied gradually until the component is secure. In any process do not exceed the stated levels.

If a torque driver is available for servicing, this will help control the applied torque; otherwise, be aware that excess force may cause the component to fail.

Pumping Block Assembly:

Stage Description	Component Description	Qty	Established Torque Process
Cover Bearing	Screw - M2x5 CSK Posi SS	4	12.5 cNm
Pumping Block to Motor Gearbox	Screw - M2x8 Pan Posi SS	3	12.5 cNm
Plate Encoder disc to Gear Camshaft	Screw - PT KC22x6 Pan Hd Torx T8	2	20 cNm

Front Case Assembly:

Stage Description	Component Description	Qty	Established Torque Process
Air Pressure Sensor Solid Base	Screw - PT WN1411 KC 25x12-Z Screw - PT WN1412 KC 18x8-Z Pan Hd Posi	2 1	25cNm 10 cNm
Pumping Block Assembly to Front Case	Screw - M3x10 CSK Posi SS Screw - M3x12 Posi Hd Z+C	2 2	30 cNm 30 cNm
Flow Stop Mechanism Assembly to Front Case	Screw - PT KC30x10 CSK (T8) Rogard	2	45 cNm
Air Sensor Assembly to Door Assembly	Screw - M2x5 CSK Posi SS	2	10 cNm
Control Board Assembly to Front Case	Screw - M3x6 Pan Hd Posi ZP+P	2	40 cNm

Rear Case Assembly:

Stage Description	Component Description	Qty	Established Torque Process
Mains Inlet Assembly to Rear Case	Screw PKT30x12 CSK Torx Rogard 500	2	70 cNm
Stud PE connector to Rear Case	Nut M6 ZP+P	2	1.5 Nm
Pole Clamp Assembly to Rear Case	Screw M3x8 Button HD Torx (T10)	3	70 cNm
Flow Sensor Clamp to Rear Case	Screw PT K30x10 Pan Hd Torx (T10)	2	55 cNm
Mains Inlet Assembly to Rear Case	Screw PKT30x12 CSK Torx Rogard 500	2	70 cNm
Rail Cam lever to Cam Rail Clamp	Screw PT KC30x10 CSK (T8) - Rogard	1	50 cNm
PSU and Comms PCB to Rear Case	Screw K30x6 Pan Hd Torx (T10)	4	40 cNm
Rail Clamp Release Lever to Pump Lever Release	Screw K30x8 Pan Hd Torx (T10)	1	60 cNm

Final Assembly:

Stage Description	Component Description	Qty	Established Torque Process
Rear Case to Front Case	Screw M3x50 Pan Posi SS	2	30 cNm
Rear Case to Front Case	Screw M3x16 Pan Posi SS	2	30 cNm
Earth Lead to Front Case	Screw M3x8 Button Hd Torx (T10)	3	55 cNm

Configured options record Alaris® GW Volumetric Pump

Enter the pump- specific information for your records on a copy of this page.

Description	Range	Default	Setting
Enable Volume / Time Infusions	(ON / OFF)	OFF	
Maximum Priming Volume	(OFF, 1 - 40ml)	40ml	
Clear Infusion Parameters	(ON / OFF)	OFF	
Maximum VTBI in MICRO Mode	(0.1ml - 999ml)	999ml	
Bolus Rate	(1 - 999ml/h)	400ml/h	
Maximum Bolus Volume	(OFF, 1 - 99ml)	5ml	
Keep Vein Open Rate	(OFF, 1.0 - 5.0ml/h)	5.0ml/h	
Single Bubble Alarm Volume	(50µL, 100µL, 250µL, 500µL)	100µL	
Enable Secondary Infusions	(ON / OFF)	OFF	
Default Occlusion Pressure	(Lo (250mmHg), Nor (350mmHg), Hi (500mmHg)	Hi	
Alarm Volume Level	(1 -7)	4	
Enable MICRO Mode	(ON / OFF)	OFF	
Maximum Infusion Rate	(1 - 999ml/h)	999ml/h	
ASCII Mode for Comms	(ON / OFF)	OFF	
Odd Parity for Comms	(ON / OFF)	OFF	
Pump Address for Comms	(1 to 250)	1	
Flow Sensor Connection Mode	(ON / AUTO)	AUTO	
Set-up of Current Time and Date	(00:00 - 23:59) (01/01/00 -31/12/99)	N/A	
Language Selection	(EnGL, dEut, FrAn,ItAL, ESPA, nEd, SE)*	EnGL	
IrDA Communications Selection	(ON / OFF)	ON	
Nurse Call Activation	(ON / OFF)	ON	
Drops per ml of Fluid	(1 to 200)	20	
Silent Mode	(ON / OFF)	OFF	
User select mode options			
• Pressure limit Enabled	(ON / OFF)	OFF	
• Alarm volume Enabled	(ON / OFF)	OFF	
• Timed infusions Enabled	(ON / OFF)	OFF	
• Micro infusions Enabled	(ON / OFF)	OFF	
Flow sensor sensitivity level	(Nor, Hi)	Nor	

*EnGL - English, FrAn - French, dEut - German, ItAL - Italian, ESPA - Spanish, SE - Swedish, nEd - Dutch.

Serial Number _____ Software Version _____

Configured by _____ Date _____

Approved by _____ Date _____

Service Contacts

For service, contact your local Affiliate Office or Distributor.

AE	***CN***	***GB***	***NZ***
CareFusion, PO Box 5527, Dubai, United Arab Emirates.	CareFusion, 上海代表机构，中国上海市张杨路 500 号， 上海时代广场办事处大楼， A 座，24 层， 邮编：200122。	CareFusion, The Crescent, Jays Close, Basingstoke, Hampshire, RG22 4BS, United Kingdom.	CareFusion, 14B George Bourke Drive, Mt Wellington 1060, PO Box 14-518, Panmure 1741, Auckland, New Zealand
Tel: (971) 4 28 22 842	电话：（86） 21 58368018	Tel: (44) 0800 917 8776	Tel: 09 270 2420 Freephone: 0508 422734
Fax: (971) 4 28 22 914	传真：（86） 21 58368017	Fax: (44) 1256 330860	Fax: 09 270 6285
AU	***DE***	***HU***	***PL***
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Tel: (61) 1800 833 372	Tel: (49) 931 4972 837	Tel: (36) 1 488 0232 Tel: (36) 1 488 0233	Tel: (48) 225480069
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Tel: (32) 2 267 38 99	Tlf. (45)70 20 30 74	Tél: (39) 055 30 33 93 00	Tel: (46) 8 544 43 200
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CA	***ES***	***NL***	***US***
CareFusion, 235 Shields Court, Markham, Ontario L3R 8V2, Canada.	CareFusion, Edificio Veganova, Avenida de La Vega, nº1, Bloque 1 - Planta 1, 28108 Alcobendas, Madrid, España.	CareFusion, De Molen 8-10, 3994 DB Houten, Nederland.	CareFusion, 10020 Pacific Mesa Blvd., San Diego, CA 92121, USA.
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Rev. B

Document History

Issue	Date	Description
2	21/05/04	Updated Logos and Marks and Front cover.
		Updated with new software features and changes.
		Data Transfer section updated due to new functionally.
		New case images.
3	12/05/05	Updated with new section on Electromagnetic Compatibility
		Updated part numbers
		Added section on storage
		Updated Occlusion Pressure Test
4	30/06/06	TSM rebrand
5	August 2007	Minor parts update for Pole clamp and Flow Sensor components.
6	October 2007	Updated part numbers.
7	February 2008	Updated Rail CAM Breakdown drawing.
8	April 2008	Updated section on replacing the Control PCB.
9	October 2008	Administration changes.
10	February 2010	TSM Rebrand and addition of Software Upgrade Form.
11	April 2010	Update Label part numbers and correct torque values.
12	August 2010	Administration change
13	March 2011	Update Spare Parts
14	January 2012	Update Preventative Maintenance section and update Spare Parts
15	June 2012	Update Spare Parts

Software Upgrade Record

Please fill out the table below and return to the local CareFusion representative, see Service Contacts for address details, to ensure the records are upto date so that any future product actions can be directed to the correct institution(s).

Hospital Name: _____ Country: _____

Product SKU	Serial Number	Processor/Software version after upgrade	Date Updated (dd/mm/yyyy)	Comments/Reference (e.g. Field Safety Notice number, Information Notice number, etc.)

Signature: _____ Name: _____ Position: _____

This manual has been prepared for use by qualified service personnel only.

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